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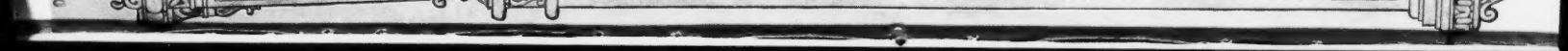

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—*Skillen—Thomas—Noyes*

The Continuous Gum Denture—*Campbell*

Annual Report of Oral Hygiene Committee for Michigan—*Hartwig*

Teaching Dental Anatomy—*Thornton*

Principles of Education by Demonstrations —*Courtis*

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The Challenge of the New Year

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THE JOURNAL
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VOL. 8 JANUARY, 1921 NO. 1

Original Communications

THE DEVELOPMENT AND STRUCTURE OF THE TOOTH APEX AND FEATURES PERTAINING THERETO

A Symposium Presented Before the Illinois State Dental Society, March 24, 1920, by William G. Skillen, Newton G. Thomas, Frederick B. Noyes

A REPORT ON THE FORMATION OF DENTIN AND CEMENTUM RELATIVE TO THE STRUCTURE OF THE ROOT END

By WILLIAM G. SKILLEN, D.D.S., Chicago, Illinois

THE consensus of opinion appears to be that the stimulating element in the development of teeth is the enamel organ. Tomes says, in discussing the invagination of the ectodermal tissue of the jaw, that "Wherever this has gone on to the formation of an enamel organ, the mesoblastic tissue seems to be stimulated to a growth." Again he says: "Coincident with the assumption of this form (bell form, Figure 1) by the enamel organ, is the appearance of the dentin germ." The same writer also states: "It has been suggested that the enamel organ governs and determines the ultimate formation of the tooth." Magitot is very emphatic in this regard. In his statement concerning it, he says: "It is explicitly admitted that the enamel organ governs and determines the place and the form of the tooth. The dentin germ, appearing subsequently, is absolutely dependent upon the presence and form of the

enamel organ." Noyes appears to confirm this when, after describing the change that has taken place in the enamel organ, and the appearance of the dentin papilla, he says: "The development of the tooth germ now progresses until the dental papilla has taken on the typical form of the tooth." Von Brunn, Ballowitz and Röse, according to Tomes, advance the importance of the enamel organ considerably. Quoting Tomes on

Fig. 1.—The tooth germ from mandible of a pig, before the germ has taken form. A, outer tunic; B, stellate reticulum; C, inner tunic, constituting the enamel organ; D, dental papilla; E, follicle.

these writers, the former two hold the primary function of the enamel organ to be that of determining the form of the future tooth; its calcification in some animals is a secondary function. Also they agree with Tomes, that enamel organs are universal, even where no enamel is found; but they go further in saying that in teeth where there is a partial investment of enamel, the organ extends far beyond the enamel limits, tracing extensions down to the bottom of the root. Van Brunn traces it between the roots of a three-rooted tooth, and says that wherever dentin is to be formed, there is an antecedent "form-building" investment of enamel organ. These writers are confirmed by Röse, who states that as soon as its increase downward ceases, dentin ceases to be formed. From these latter writers, we therefore draw the conclusion that the enamel organ is an important adjunct to the root development, which conclusion we are substantiating in the present work.

As the enamel organ plays such an

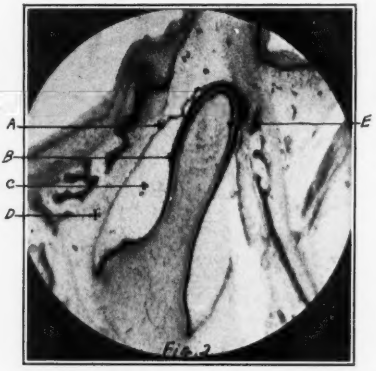

Fig. 2.—The tooth germ from maxilla of pig. Calcification of dentin beginning at x. A, outer tunic; B, ameloblasts; C, stellate reticulum; D, follicle; E, odontoblasts on surface of dental papilla. Over the cusp the outer tunic is in contact with the ameloblasts.

important part in the development of the root, it would seem necessary to describe it briefly. Previous to the formation of enamel or dentin, the organ consists of two layers of cells known as the inner and outer tunics, which are separated by a layer of tissue composed of stellate cells and known as the stellate reticulum (Figure 1). The cells of the inner tunic later specialize into ameloblasts whose function is to form the enamel. Between the ameloblasts and the stellate reticulum is a second layer of cells to which has been given the name of "stratum intermedium." These cells

appear to be developed, says Leon Williams, from some of the cells of the reticulum which have not been converted into stellate cells (Figure 3, E). At first they are irregular, spindle-like in form, changing their shape as development goes on, so that about the time enamel calcification takes place, they are distinctly cuboidal (Figure 4, B). This writer's description up to this point agrees with ours. He goes on to state, however, that the ameloblasts are surrounded by epithelial papillae around and between is a free distribution of capillary loops. We assume that this papillary layer is developed from the stratum intermedium, for he further avers that "while the cells of the inner tunic are assuming the character of ameloblasts, those of the outer tunic are disappearing." Our work shows that the papillary layer is formed by apposition of outer and inner tunics, which takes place gradually. When this has occurred, calcification begins, the first appearance of which is over the tip of cusp or cusps (Figure 2). For this we find supporting statements in the literature from Waldeyer and Paulhold. It is true that the cells in the outer layer degenerate considerably, changing from their original columnar shape into a spindle form, but that they disappear we do not believe. In Figures 2 and 3, which show progressive stages of development the outer tunic and even the stellate reticulum are in evidence. Williams finds support in Kolliker, Legros and Magitot.

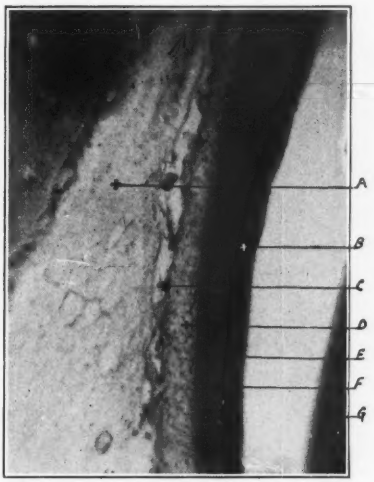

Fig. 3.—Middle third of crown of developing cat's temporary tooth. Arrow points toward tip of cusp. A, follicle; B, enamel, part of which has been lost in decalcifying; C, blood vessels, injected, and outer tunic; D, stellate reticulum; E, stratum intermedium; F, ameloblasts; G, dentin.

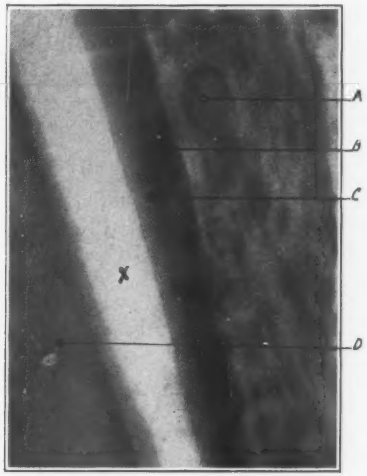

Fig. 4.—Section of enamel organ near gingival. A, papillary layer enclosing blood vessels; B, stratum intermedium; C, ameloblasts; D, dentin; at x, enamel which has been lost in decalcifying.

As to the vascularity of the enamel organ there appears to be considerable confusion. Wedl, Magitot, Legros, Sudduth, Paul and Tomes have been unable to detect any vessels in the "enamel organ." Hopewell-Smith says the external epithelium and stellate reticulum have no blood supply, but that large vessels traverse the reticulum and

pass to the stratum intermedium where they break up into small capillaries. Leon Williams supported by Beale, Howe and Poulton, find blood vessels in the papillary layer. Williams also finds them encircling the outer tunic before it disappears, but nowhere else.

Our work will show by injected as well as non-injected specimens, that surrounding the outer tunic there is a network of vessels (Figure 3, C). We have been unable to find any trace of these in the reticulum or surrounding the stratum intermedium, thus substantiating Williams. But when the outer and inner tunics come into apposition, thus forming the papillary layer, the vessels accompany the outer tunic and so come to lie in the position described by Williams (Figure 4). Leon Williams has given to these vessels the function of supplying the materials to the ameloblasts by which enamel is formed, and it is interesting to notice that, in our description, we find these vessels approaching the ameloblasts in company with the outer tunic at about the time calcification is to take place. As enamel formation progresses, more and more of the outer tunic is brought into contact with the ameloblasts. As seen in Figure 3, the gingival extension of the enamel may project beyond the point at which these structures are in apposition.

It will be seen, then, that the structure of the enamel organ covering the crown of the tooth at the time calcification is taking place, consists of three layers as described by Williams, namely, the ameloblasts, the stratum intermedium and the papillary layer enclosing blood vessels (Figure 4). Whether all of these layers continue to descend as the "stimulative layer" of the root, is at yet undetermined.

As development progresses, or rather after their function is performed, the uniform arrangement of the cells is broken up, only those farthest apically maintaining definite form where stimulus to the mesodermic tissue is still required. Figure 5, A, will show this apical extremity, and Figure 5, a drawing of this area, will show the details of its structure. The loop which is

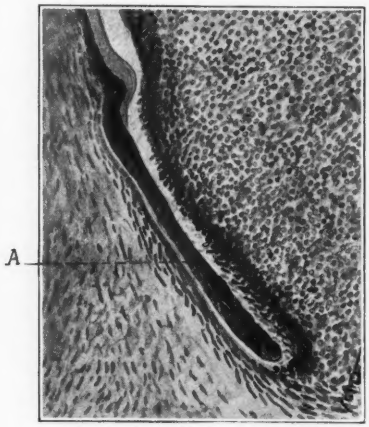

Fig. 5.—Drawing of root end of dog's temporary tooth one month after birth, beginning eruption; cf. Fig. 8 A, stimulative layer.

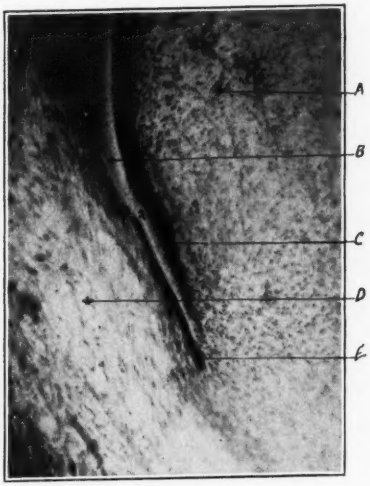

Fig. 5A

characteristic of the base of the enamel organ where the inner tunic is continuous with the outer tunic, is clearly evident. (Compare Figures 5 and 2.) Apparently it consists of two layers of cells, the inner which would correspond to the ameloblastic layer, being more differentiated than the outer layer, which would correspond to the outer tunic. The same arrangement will be seen in Figure 6. The latter is a view of the stimulative layer from the middle of the descending root. It and the follicular tissue has been torn away from the surface of the dentin. Two layers of cells are distinctly seen; and from the similarity of the loops in Figures 5 and 2, it is evident that the ameloblasts and the outer tunic are the two layers composing the stimulative layer. It seems also, that the blood vessels do not continue to descend in as close a relation or with the same regularity with these cells as where the crown is being formed. Leon Williams has associated the cells of the stratum intermedium with enamel formation, and it is possibly due to the failure of these cells to descend as part of the stimulative layer, as well as the lack of continuity of the blood vessels, that no enamel is formed on the root. It is quite evident from the illustrations that the cells forming the stimulative layer have lost their characteristic specialized appearance, which in teeth of continuous growth, is maintained down to the end of the root. In these types, that condition as shown in Figure 14 is typical, as described by Leon Williams. In Figure 7 the cord of cells will be seen continuing apically thru the fibres of the follicle, from the enamel organ at the bottom of the gingival space, separated for a slight distance from the tooth surface, but swinging back to take their normal position as the apex is approached (Figure 8). From their arrangement and appearance as they pass down thru the fibrous tissue, they vividly suggest by their striking similarity, the epithelial cords of the peridental membrane.

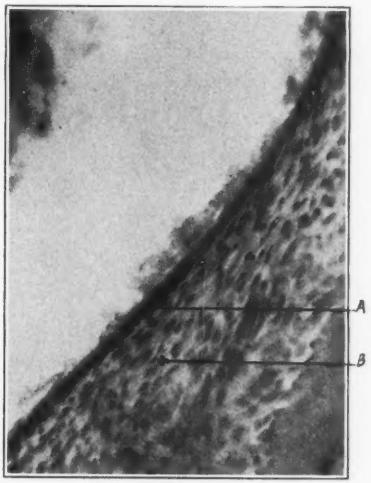

Fig. 6.—Stimulative layer from middle of the root of dog's temporary tooth three days after birth. Layer is separated from dentin at x. A, stimulative layer; B, follicle.

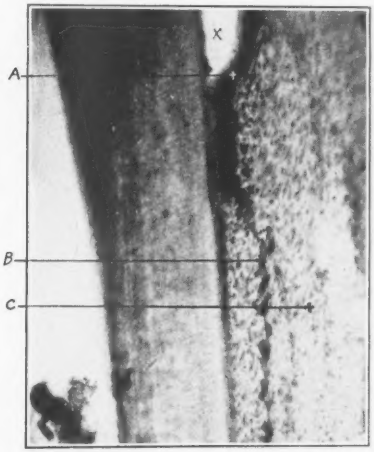

Fig. 7.—Temporary tooth of pig, eruption just commenced. x, enamel which is lost; A, enamel organ continuing down surface of root, and B, its appearance as it passes down thru follicle C.

In Figure 5A may be seen the relation of the various structures as root formation proceeds. The enamel organ or stimulative layer, E, is always slightly in advance. Then comes a point at which the odontoblasts, C, are assembling to form a row of cells adjacent to the enamel organ, and immediately occlusal to this point, the thin layer of dentin which becomes thicker as the crown is approached, B. A study of the

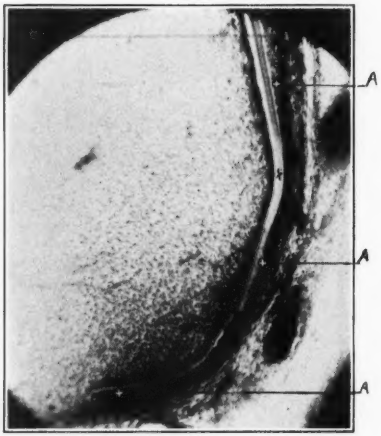

Fig. 8.—Continuation of 7 at apex. A, stimulative layer. Note the distribution of the formed and uncalcified dentin.

dentin will show a characteristic difference in appearance. Next to the odontoblasts is a light staining layer of uncalcified dentin, external to which the tissue is formed and stains typically. As Mummery and others have pointed out, dentin consists of an organic matrix in which inorganic salts are subsequently deposited. With the deposits of the inorganic salts, the tissue responds to basic stains, leaving the organic material unstained or responsive to acid stains so that they are readily differentiated. This arrangement of uncalcified and formed dentin persists throughout the formation of the root, the uncalcified product of the odontoblasts always preceding the adult tissue (Figures 5A and 8).

It will be evident that the condition of the root end at the time of eruption will depend greatly on the rapidity with which the tooth approaches eruption. If it is delayed in taking its position in the mouth, the dentin will be considerably thickened and more fully calcified, and if hurried, the condition shown in Fig-

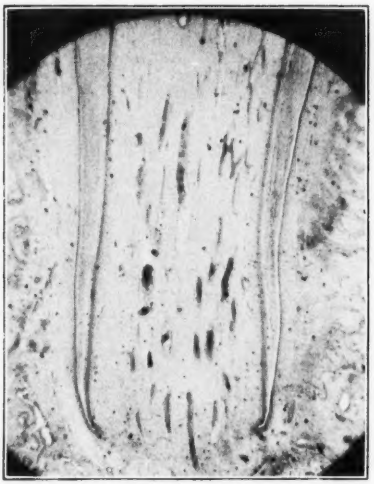

Fig. 9.—Root end of dog's permanent molar in full occlusion. Note distribution of formed and uncalcified dentin.

ures 8, 9 and 10, will be presented. Which is the normal method, or whether both are normal, is indeterminate. It is evident, however, that the condition of the root end at the time the tooth meets the forces of mastication, will have a strong bearing on the character of the finally completed apex.

A comparative study of the illustrations will show the change which has occurred in the tissue at the base of the papilla and in the follicle during the period of development. Cellular in character in the beginning, this tissue has gradually become more and more

fibrous. The change is also hastened, as is the root end itself, by the stimulation of the forces of mastication. The more fibrous condition offers greater resistance to the downward passage of the soft, yielding stimulative layer of cells and a gradual contraction of the root takes place. Figures 5A and 10 especially will illustrate the conformity of the root end to the direction of the surrounding fibrous tissue. The teeth in both of these specimens have penetrated the

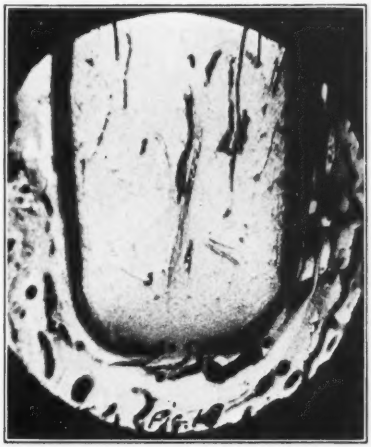

Fig. 10.—Root end of pig's erupting tooth same as Figs. 7 and 8.

mucous membrane, the latter the more advanced one of the two. It will appear from Figure 10 that the converging sides of the stimulative layer are due to meet which is not the case in Figure 9. It is evident that this condition must result in a difference in the method by which the apex is completed, and consequently the relations of the adult tissues in this region will vary.

There appears to be no definite statement in the literature regarding the time cementum formation takes place. Tomes says: "At the time when the crown of a tooth appears thru the gum—the root has yet to be calcified; as each portion of the dentin of the root is completed, it is coated by the follicular wall. The dentinal face of this membrane presents cells, the osteoblasts of Gegenbaur, and it is by their agency cementum is formed." Broomell shows a deciduous tooth, unerupted, at three months after birth, on which he states no cementum is formed. Hopewell-Smith says: "Cementum is formed about the time of the completion of the crowns." Talbot

Fig. 11.—Section from middle of root of Fig. 9.

avers that cementum is formed after dentin has outlined the root.

We have been unable to find any cementum up to the time the tooth is in occlusion. That it may not begin to be formed sooner than this, we do not undertake to say. It seems to us that its development must depend upon the stimulation caused by the forces of mastication. Cementum must be considered as a tissue of attachment, and the cementum forming cells, similar in function and character to osteoblasts, will not be stimulated to activity until masticatory stress is applied. Figure 11 is taken

from a section of the root of a dog's permanent molar in full occlusion, similar to Figure 9. The tissue was specially treated to stain the tubules by the method worked out by us and recently published, and by means of which the distribution of the dentin is made more evident. It will be seen that some of the tubules end in the surrounding fibrous tissue of the follicle. The fibres of the follicle are not arranged in the adult manner, but run parallel to the root, which would indicate that no attachment to the root has as yet taken place. A close examination, however, will reveal, at D, the tissue of the follicle separated from the surface of the dentin by an almost unstaining, homogeneous substance which, for lack of a better knowledge and with great hesitancy, might be said to be cementum. It is so lacking in substance that we must consider it inappreciable in importance.

To emphasize the facts of the foregoing, the following resume is made:

1. The outer tunic of the enamel organ does not disappear. As calcification proceeds, it is gradually adapted to the inner tunic forming the papillary layer. The net-work of vessels which are found encircling the outer tunic, accompany it and so come to lie in the papillary layer in close relation to the formative cells.

2. In no other part of the enamel organ, except the outer tunic, are vessels found.

3. The enamel organ extends apically as a "stimulative layer" to root development. It precedes the appearance of odontoblasts and dentin. Its presence is considered necessary to odontoblasts organization.

4. The stimulative layer appears to consist of the ameloblasts and the outer tunic. The ameloblasts have become very rudimentary in character. The blood vessels do not remain in their normal close relation to the cells. The appearance of the layer strikingly resembles the epithelial cords of the peridental membrane.

5. The conical form of tooth roots appears to be due to the fact that as development proceeds, the tissue at the base of the papilla and in the follicle, is gradually becoming more fibrous and so offers more resistance to the downward passage of the soft, yielding layer of cells forming the stimulative layer.

6. The result of the stimulus of the forces of mastication on the tissues at the root end will have a decided influence on the manner in which the apex is finally completed.

7. At the time the tooth comes into occlusion, the root end consists of a more or less thin tapering layer of partially calcified dentin. This condition will depend upon the rapidity with which the tooth erupts.

8. No cementum has been found on the root up to the time the tooth is in occlusion.

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FORMATION OF THE APICES OF TEETH

By NEWTON G. THOMAS, M.A., D.D.S., Chicago, Illinois

THE preceding declarations concerning the formation of dentin and cementum have their culmination to a large extent for us in the formation of the apices of teeth. I do not mean that the relation of these tissues is not important elsewhere for I am led to believe that few of us appreciate the actual tissue structure and its importance in these parts. But the apex of the tooth and its pathological vicissitudes come to our minds as the region of most concern. We are quite ready to say that if the apices of teeth could be immunized against disease we would cheerfully volunteer to care for cervical irregularities.

There are some conceptions that must be clear to us in order to picture the procedure implied in apical formation. We must recall the tubular structure of dentin and remember that it forms from without inward. That is, the dentin next to the cementum is formed before cementum appears and it progresses centrally at the expense of the pulp. The tubules branch profusely thruout their length from pulp to stratum granulosum. The granular layer extends from the gingival line beginning narrowly, but widening as it approaches the apex. Between the layer mentioned and the cementum is a clear, homogeneous strip of tissue that can be easily traced entirely around the root. This layer has been denominated differently, sometimes as cementum and again as dentin. It is enough at this time to say that it is structureless usually and is as calcified as other parts of the tooth. External to this is the cementum which is of varying thickness and usually quite definitely laminated altho the laminae are best defined in the apical region. Normally, too, in this region we find cementum lacunated, the lacunae being the greatest in number at the apex proper. Also the lamellae are characteristically striated, due to the imbedded fibres of the peridental membrane. Lastly, we must keep in mind that probably no cementum is formed at all until the tooth appears in the mouth. The only retention that the tooth has at such a time is afforded by the continuity of the fibrous elements in the matrix of the dentin and the surrounding fibrous tissue of the follicle.

The foregoing will doubtless call to our minds the general arrangement of tooth tissues. One fact more must be stated however. The tissue arrangement in teeth refuses standardization. Enamel is heavily or lightly incremented in the same mouth and in similar teeth. The dento-enamel junction seldom presents uniformity. Sometimes tubules extend into the enamel in profusion; sometimes but slightly. The granular layer may run smoothly with an orderly arrangement around the root or present bulgings and contractions almost disappearing in places or because of its exaggeration wholly obliterating the clear layer that we expect to find between it and the cementum. It is evident that for almost any propaganda concerning dental tissues one can find a text. This will apply with added weight in the consideration of apical tissues as the apex is subject to all the variations of occlusion and mastication. There we find every gradation from what we might consider normal formation to a veritable chaos of arrangement.

Perhaps the most interesting of root constituencies is the stratum granulosum.

And this may be true because we know so little about it. Since Tomes first described it, little has been added to our knowledge of it. We know nothing of its histogenesis or function. In the ground sections it is seen as a narrow strip having a sanded appearance, placed upon the periphery of the dentin. It usually begins at the gingival line altho

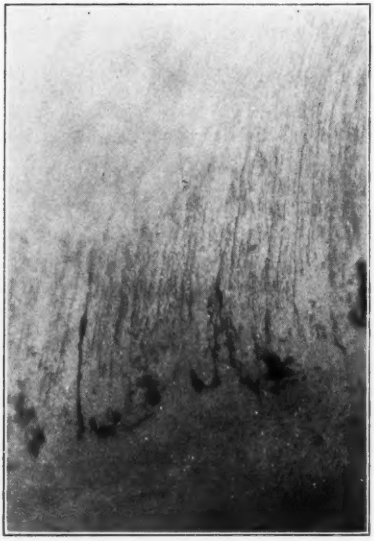

Fig. 12.—Showing tubule terminations in the granular spaces.

Black refers to it as extending coronally beneath the enamel (1). This I have never seen. In its progress toward the apex it usually widens until it is many times its cervical width. Concerning the granules, most authorities are agreed that they are actual spaces filled with protoplasmic material in which the processes of the odontoblasts terminate. Boedeker stated long ago that these spaces communicated with the cemental lacunae (2). This statement has found scant support because Boedeker left neither picture nor method of demonstration. In his dental histology and embryology, Noyes calls attention to the fact that the spaces are invisible in sections stained with haematoxylon and eosin and that to his knowledge they had never been stained (3).

Over a year ago when Dr. Skillen and I were working in the same laboratory, we sectioned and stained a block of tissue that had been given us already in

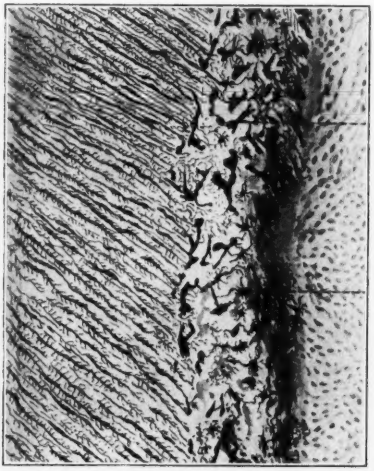

Fig. 13.—Showing obliteration of the structureless layer and continuity of tubules, spaces and cemental lacunae.

Zenker's fluid. More than that we did not know. When the first section was examined we found the stratum granulosum distinctly stained. After months of tireless work, Dr. Skillen was able to stain the granules with perfect ease. By that process, which will appear in an early issue of the Cosmos (5) the granules were found to be in keeping with the appearance of these same structures in ground sections. Also they agreed in the same puzzling irregularity of dental tissue arrangement. In some instances they were tufted tubule endings, the

coiled tubule ends being branched as were the tubules elsewhere, or they were minute swellings or wide, irregular canals or multiformed lakes. (See Figures 15 and 16).

It was further observed that the stain was effective in showing the dental tubules from pulp chamber to the granules; (see Figures 12 to 16). It showed the imbedded fibres of the peridental

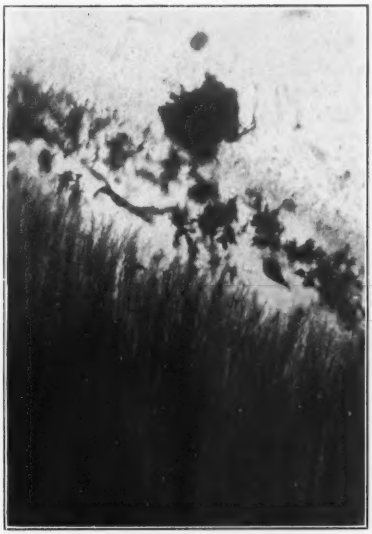

Fig. 14.—Showing granule forms, branching of tubules as demonstrated by the Skillen stains.

Fig. 15.—Same as Fig. 14.

membrane in the cementum, (see Figures 13, 16) the lacunae of both cementum and bone with their minute canaliculi (see Figures 13, 16). It demonstrated tubules extending beyond the periphery of the dentin in the same way and in a similar proportion to the extensions seen in the enamel. (See Figure 11). Taking these things together, sections stained by this method were of immense value in the study of root apices.

Already we have seen that the dentinal outline of the tooth is developed longitudinally much more rapidly than medially. (See Figures 9, 17). At this stage the root consists of two splinters of dentin, the sharp tips of which are not calcified. Studying many teeth we observe that to this point, roots of all teeth are similar in formation. Here the changes intimated begin to appear. We note that the two splinter ends of root curve gently toward each other, the central sections of the tooth showing them almost together, save for the point of ingress of the vessels and nerves. In the gross, the root would be represented by a thin walled tube brought to a rounded finish save for a central opening—the apical foramen. (See Figure 10). We also see the root tips remain apart, closure being postponed until sometime after the tooth has come into occlusion. (See Figures 9, 17). In the gross we have a funnel-shaped opening with which we are all familiar.

As stated, in both instances the major

portions of the roots are formed similarly. The longitudinal and medial development goes on without differentiation, apparently until the incisal or occlusal surfaces are subjected to mouth influences. Then variations appear in the development of the apex. Explanation of this is found in the protection afforded the papilla thruout most of its length by the elongated root when occlusion is reached. Thus the base of the papilla alone suffers. (See Figures 9, 17).

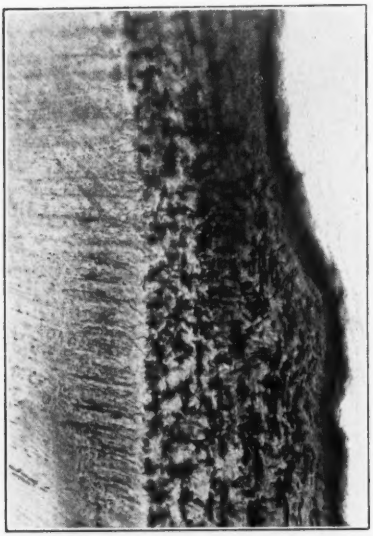

Fig. 16.—Showing mixture of granular spaces and lacunae on axial surface of root.

Another factor that undoubtedly enters into the list is the length of the root as it effects stability, the longer root allowing less apical movement. Still another element to be considered is the variation of supporting tissues and the energy of the cellular response that orthodontists note so often when the reaction in the mouth of a child disappoints while that in the mouth of an older person favorably surprises. In the light of this explanation, we would expect an irregular arrangement of the short rooted tooth altho, at this time, an explanation of the failure of longitudinal development is impossible.

It is difficult to state that any particular tooth is prone to an irregular apical formation inasmuch as the exigencies of tooth eruption are so varied As a general statement, one would conclude that the incisors are less likely to show disturbance than molars because they have no frictional function with the teeth opposing them. Still we find dentitions in which there is direct occlusion between the incisors of the two arches. Again, it would seem that the more rapidly developing roots are more apt to form regularly than the slower growing teeth. Still the vicissitudes of tooth development are practically unknown to us and it is clearly evident that the

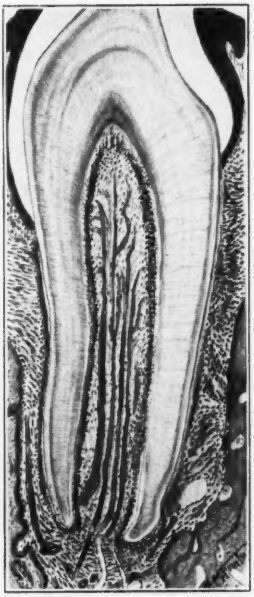

Fig. 17.—Showing delayed closure of the root apex.

cause of the irregular arrangement of the tissues at the apex or, for that matter, the tissues elsewhere need not be mechanical at all. Cellular insufficiency from any of countless causes may explain more than the mechanics.

In the first method of foramen closure mentioned, the picture is of a tooth in which the tissue elements follow a regular arrangement. The dentin in the completed structure is uniformly thick and the tubules regular. The pulp canal tapers uniformly to the end of the root. The granular layer and the homogeneous clear layer extend evenly and unbrokenly to the apex. Cuts of such may be seen in almost any text book. This presents what to our conception is a normal development. It might be well to say that such a smoothly constructed tooth is very seldom seen. Under these circumstances the stimulative cells that have been described are guided by the curvature of the follicle and the dentin deposit takes the same curve. (See Figures 8, 10).

The second method presents a similar procedure to the first until the apex is reached. The procedure of closing the foramen presents the point of variation. Instead of the gentle curvature of the stimulative cells in conformity with the follicle wall, we observe that the foramen remains wide and in the apex on the pulpal surface of the forming dentin the deposit of that tissue is retarded, causing a funnel-shaped opening while higher in the pulpal cavity the progress of dentin formation goes on unretardedly. (See Figures 9, 17). The stresses applied to the tooth while in partial or complete occlusion have the effect of advancing the development of the pulpal tissue filling the funnel-shaped space described, changing it from the delicate embryonal-like type characteristic of pulpal tissue to a more resistant fibrous tissue.

From the condition described above, two results seem to follow. In the changed tissue filling the apical funnel, odontoblasts retrograde and functionate poorly laying down dentin similar in its irregularity to secondary dentin, the tubules being smaller and having no definite direction. Cementoblasts also appear and the two tissues are inextricably mixed. Another procedure is sometimes seen when cementoblasts appear upon the inner or papillar surface of the follicle, rounding out the root end and closing the foramen with a wall of

Fig. 18.—Cementum deposit between vessels with slight or no dentin formation.

cementum. (See Figure 18). Not knowing the histogenesis of the granular layer the appearance of granular spaces cannot be explained here, but in the completed apex we find that lamellation of the cementum is lost due to the mixture of tubules, granules and cemental lacunae which appear confusedly. In such areas, if microscopic determination is of any value, tubules, granular spaces and lacunae are seen to anastomose freely, thus linking the pulp directly with the peridental membrane. (See Figures 11, 13, 15, 16). In this region at least, Boedeker was right and is sustained upon occasion elsewhere, as it frequently occurs that after a tooth has erupted

disturbances, probably due to the mechanics of mastication, cause an irregular mixing of granular spaces and lacunae with the same result of continuity.

While thus far only the order of tissue deposit has been mentioned, another element enters into the consideration. An element that is a quite constant characteristic of the tooth apex—multiple

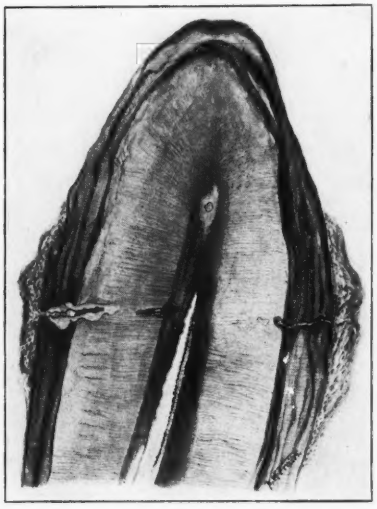

Fig. 19.—Two lateral foramina almost in mid-root.

foramina. It is not to be assumed that always the vessels gather into a convenient bundle in the center of the dental papilla requiring but one foramen for their accommodation. Equally as often and perhaps oftener, the vessels and nerves offer combined resistance to the descent of the stimulative cells and the plastic dentin with two possible results; either the continuity of the vessels is broken and collateral circulation established or for some distance they are carried before the forming tooth structure. Sometimes they afford resistance sufficient to maintain themselves against the encroachment of the forming roots and multiple foramina are the consequences. Thus it will appear also that the point of entry of the vessels into the papilla will have much to do with the position in which foramina appear. In many series of sections the vessels entering the papilla are placed in intimate contiguity to each other. The result is a central foramen. (See Figure 10).

Altho foramina are distinctly apical

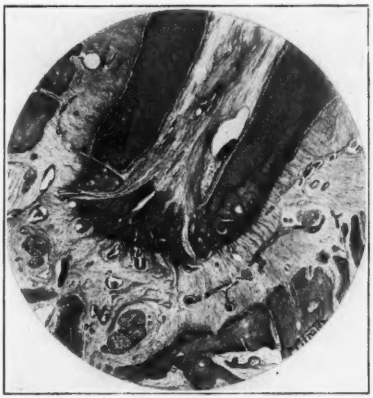

Fig. 20.—Showing multiple foramina and apical pulp attachment.

characteristics they are found elsewhere. As suggested before, the point of entry of the vessels and nerves thru the follicle is a determining factor in their location. Inasmuch as the follicle is never so dense elsewhere as it is at the base of the papilla, the structures do not offer so much resistance to the forming root wall. Occasionally, however, they appear high on the axial walls of the root and have been described as occurring at or above the gingival line. Such foramina are very probably the result of absorption having its beginning in the pulp chamber. In a very thoro work on multiple foramina Hess contended that

in later life the apical foramina were closed by cementum deposits and as a result, compensatory canals were developed. (See Figure 19). In occurrence, at least, this agrees with Salter and others altho the one regards them as pathological while the other thinks of them as physiological.

There is little doubt that many canals seen in the apical region in individual sections, both ground and decalcified, do not communicate directly with the pulp. Many of them are imbedded vessels, their loopings being plainly demonstrated in serial sections. Sometimes such loopings arise from and terminate in the pulpal wall. When such occur in thickened cementum, their presence plus the lacunae of the region have been interpreted as Haversian systems which interpretation superimposes upon them something that the structures themselves do not justify. Nor does it seem to me that such structures can be explained by calling them atavisms or by embryological recapitulation. It seems that more than an imbedded vessel is required to call the tissue vaso-dentin or to relate the two. The simpler explanation, interpreted in the light of the variable environment of teeth is preferable, tho perhaps less scholastic.

Another characteristic apical structure element is the imbedded fibres of the pulp. From the specimens studied, it is evident that these fibres are developmentally farther advanced than can be found elsewhere in the pulp. The explanation for this circumstance has been given. They are distinctly visible in Figure 20. Their presence explains what every worker in this field has experienced, that pulps invariably offer resistance to removal in the apical area. Elsewhere they come away from the chamber and canal walls readily, the only form of attachment prevailing there being the odontoblastic processes extending into the dentinal tubules. In sections imbedded fibres are readily demonstrated. This is a terminal process occurring when the apex is closed. The fibrils are not gathered into bundles, but are traceable separately into the calcified tissue. (See Figure 20).

The facts before us, then, are that in tooth structure we have infinite variety of arrangement, each tooth being in large measure a law unto itself. The apical area is subject to great irregularity due to stresses and strains of occlusion brought upon it before the completion of the root. The confusion of tissue elements which may occur laterally on roots in the apical region or at the apex proper often shows continuity of tubules, granular spaces and canaliculi of cemental lacunae. The vessels and nerves are the principal agents in multiple foramina formation.

In the foregoing, no attempt is made to suggest completion of research on this subject; no attempt is made to establish a rule or set of rules; no attempt is made to give advice upon the bearing of such findings as I have presented upon operative or therapeutic procedures. The simple statement of such facts as we have observed is the beginning and end of our endeavor. The apices of teeth with their complex structural characteristics simply state their own case and offer their challenge to our best endeavor in operative and therapeutic technic as well as scientific investigation.

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STRUCTURAL CHARACTERISTICS OF THE REGION OF THE ROOT APEX

By FREDERICK B. NOYES, B.S., D.D.S., Chicago, Illinois

IT IS a great pleasure for me to follow as the last speaker in this symposium. This material has all been prepared by Dr. Skillen and by Dr. Thomas; it is their work, and they deserve the credit for it. They have prepared a beautiful set of slides showing many interesting things. I have had the opportunity of studying all of this material, and my place now is perhaps only to try and link up a little of this material with dental practice. It is only by work like this that the basis for clinical practice is firmly, satisfactorily and intelligently established, but in all history, clinical experience has preceded the scientific laboratory. Men knew how to make butter for centuries before they knew it was a bacteriological problem, but after they knew it was a bacteriological problem, they found a dairy could produce butter of the same quality and of the same color every time. While clinical experience has preceded the scientific laboratory scientific work has explained clinical experience and developed the principles which have led to clinical advancement.

Years ago, when I was first interested in the study of dental histology, Dr. Black was studying and teaching the histology of the enamel with reference to the preparation of cavity walls and the peridental membrane and its relation to tooth movements, and as you look over the literature in dentistry today you will find that the rules which he laid down, based upon his microscopic study of the structure of the tissue, have become accepted as the explanation of, and the reason for, the clinical rules in the preparation of cavity walls. At that time, the preparation of cavities with reference to the treatment of caries as a disease of the teeth was the subject which most occupied the intelligence of the dental profession. It was the great question. Today the question of the fate of the pulpless tooth, is the one that is most occupying the intelligent consideration of the dental profession, and that question will never be answered until a vast amount of scientific work has been done in the laboratory upon which the clinical rules of procedure can be based. I want to digress for a minute.

My old teacher, Professor Brooks, in his lectures in biology used to tell a story. He said that the characteristic of life was the power to react to its environment. Initiative, not environment, was the thing that distinguished living from dead matter. He said, if you kick a football you can calculate exactly what will happen. It will travel so far by impulse acting against the resistance, and it can be mathematically calculated; but if you kick a dog, you cannot tell what will happen. Then, he said, lest you should think that life is without its laws, what will happen depends upon a great many things. First, for instance, it depends upon the breed of the dog, his heredity. It depends upon where the dog is, whether on his own property or somebody else's property when he is kicked. It depends on who kicks him, whether it is his master or a tramp, and

so, he said, if you knew enough about the vital laws of that dog, you could calculate what would happen. But the difference is that the dog responds to his environment with an explosion of energy within himself, and you cannot measure that energy beforehand.

To illustrate it again with reference to the problems today before the dental profession, if you wreck a man from New York on a desert island, he does not sit down on the sand and starve to death because he has not a negro waiter to bring his breakfast, but he responds to his new environment and gets his breakfast. But if you wreck two men from New York on two desert islands exactly alike, one may starve to death, and the other will live. Why? Because of the difference in their reaction to the same environment.

Now, when you are dealing with teeth and pulpless teeth, remember that the tissues are made up of cells which have a certain degree of individuality, just like the two men, and whatever you do to them, they will respond to their environment, but one may die, while the other one may live.

Now, scientific work in the laboratory can never come to you and say: "Here is a fact; you must always do so and so." It can only clarify the principle upon which clinical judgment and procedure are based. The work from the laboratory is only one item in clinical evidence, which in your judgment, determines what you should do, just the same as the radiograph is only one item in clinical evidence which, with all the other items, determines your judgment of the vital reaction. I feel then at this time like saying, beware of the report from the research laboratory which rushes into print with a new discovery, and says, always, "It is so and so," or "always extract pulpless teeth."

In the study of any subject it becomes more and more amazing how quickly we get to the limit of knowledge. We will find it is easy to take freshman students in the histological laboratory and show them all we know of a certain subject.

The first item assigned to me is the relationships of the tissue elements in the apical region. I am not going to stop to review the subjects that have been presented by Dr. Thomas and Dr. Skillen as time is too short this afternoon, but I want to call your attention to one or two things.

First, imagine the end of the root, where the fibers of the peridental membrane are built into that tissue as soon as the cementum is formed, and the whole surface is covered with fibers built into it which stretch in bundles from the cementum to the wall of the alveolus. These are close about the openings thru which the vessels pass to and from the pulp. Imagine this magnified so large that you could crawl out thru this apical foramen and come to the surface of the root at the apex. (Indicating). You would find it impossible to move along the surface of the root because of the enormous fiber bundles, which like tree trunks spring so closely from the surface that you cannot pass. The fibers are all built into this surface. Between these fibers you can pass out toward the wall of the alveolus and the spaces filled only by light cell growths become larger. When an infection passes from the pulp of the tooth thru these channels, it does not spread along the surface of the root for the reasons I have expressed, but it passes out between the fibers, following the course of the vessels especially the lymphatics. The reaction to the infection occurs in the portions of the peridental membrane in its outer half towards the bone and encroaches more rapidly upon the bone

than in the other direction, and the tissue changes result in the formation of inflammatory areas, which spread out in this direction. (Indicating). I want to emphasize that because even when these inflammatory reactions become extensive, (and the more I have studied sections of the roots which show these reactions, the more I am impressed with the fact) the surface of the cementum is the last area upon which these tissues are destroyed, and it seems to me that is one of the items of hope in our problem. If the fibers were immediately cut off from the cementum, and the cementum immediately had no probability of returning to usefulness, it would be unfortunate and the probability of return to normal would be greatly reduced.

For a great many years in talking about dentin, I have tried to impress students with the idea that the dentin contains two kinds of organic matter. There is a gelatin yielding organic basis for the dentin matrix, with which the inorganic salts are combined, and thru that dentin matrix there are holes which we call the tubules. These are holes thru the solid matrix, consequently we call them tubules, and these tubules are filled now with living cytoplasms. So you have two kinds of organic matter in the dentin, living cytoplasm, filling the dentinal tubules, and the gelatine yielding basis for the dentin matrix. I know, for my own part, and I believe it is true of most of you, that I have never realized the amount of material contained in the dentinal tubules. I am not a good enough mathematician to calculate its amount. These tubules are from one to three microns in diameter, and are separated from each other by eight to ten microns of dentin matrix. In other words, you have tubes of say two microns in diameter, and solid dentin matrix of from eight to ten microns between them. If you take a piece of clay and poke a hole two inches in diameter into the clay, and at ten inches poke another hole, and at another ten inches another hole until the whole piece of clay is poked full of holes, you will have a mental picture of the dentin matrix. In addition, there are innumerable little side branches running from one hole to another. Without calculating, it is safe to say that one-tenth of the volume of dentin is the contents of the dentinal tubuli, and in the living subject, at least at a certain stage, this is living cytoplasm.

This is an old diagram, but it illustrates the odontoblasts, the dental tubuli, and the protoplasmic portion extending from the odontoblasts, passing thru the dentinal tubuli, to the surface of the dentin. When a pulp is removed that material is not removed. The chemist will tell you that the cytoplasm which is killed by the removal of the pulp undergoes autolysis. This cytoplasm contains enzymes which will break it down, will split it up, and these split proteid products are among the most poisonous substances known. But now, do not jump at the conclusion that the teeth have all to come out, because we do not know; the chemist goes on and tells us that the poisonous products are only a certain stage in this decomposition. The cytoplasm is immensely complicated. It splits into certain products which are simpler and at a certain stage we have exceedingly poisonous products, but these products by the same process are also decomposed and become harmless. We are not in a position to know whether the decomposition products of the contents of the dentinal tubules may become a menace or not, simply from a chemical standpoint of the possibility of production of poisonous and irritating substances.

I said a minute ago that we know certain things about the contents of the dentinal tubuli. We think we know that at certain stages in the formation of dentin, these tubules are filled with living cytoplasm.

In the completion of the dentin and reduction in the size of the pulp chamber, we know that not all of the dentinal tubules continue in the new formation of dentin, and while I am perfectly satisfied that at a certain period in the formation of these dentinal tubules, they are filled with living cytoplasm, I am not by any means convinced that they are all filled with cytoplasm thruout life. We do not know what happens to these tubules in the adult periods of the teeth. I think we know as little about the contents of the dentinal tubules as of anything in connection with the teeth, and believe me, some one has got to do a good deal of hard work before we find out, because you can hardly imagine a more difficult field of work than the study of the contents of these dentinal tubules. The technical difficulties of this investigation are enormous. So do not expect anybody to go into the laboratory and prepare a paper for the National Dental Association that will tell you all about it. (Laughter).

The next slide shows the contents of the dentinal tubules. What is their fate after the removal of the pulp? The thing I want to impress upon you is that we do not know, and we must know about it before the fate of the pulpless tooth is intelligently answered. Here is an element in clinical evidence which must be weighed and we do not know the facts.

Let us assume that it does produce poisonous substances. If these are going to do harm they must pass thru the dentin to the cementum and peridental membrane. We do not know whether they can or not. We are slowly accumulating evidence on this point. We have had a little evidence this afternoon. We have had in the journal literature of the last few months several items of evidence, but these are not at all conclusive. They have to be held for a long time before the question of the relationship between the tubules of the dentin and the spaces of the cementum is answered.

The granular layer of Tomes is to the fore. I think you have had given to you this afternoon the most satisfactory presentation of evidence that has yet appeared on the granular layer of Tomes, but the men who presented it, you will notice, do not consider it as conclusive. It is not complete. It has been shown in many slides, both from ground and decalcified sections.

Whatever we may find out in the future, we know that the dentin is formed and nourished from the inside and is formed from without inward, and that the cementum is laid down on the outer surface of the dentin after it is formed, or after that surface is completed and is formed from within out and is formed by cells which are nourished from the outside, from the follicle wall or the peridental membrane.

Not until somebody has the energy to remove a lot of pulps from experimental animals and make sections to show whether there is any reaction in the cementum and peridental membrane and checks against these, control sections from teeth with living pulps, will we have any evidence as to poisonous materials from the decomposition in pulp chambers affecting the vitality of cementum and peridental membrane.

In the formation of the dentin, the process becomes more and more complicated as it goes on and the apex of

the root is approached. The conditions of nourishment become more complicated, and consequently the formations become more imperfect.

Dr. Thomas has shown you the way in which dentin is formed, and the fact that it retains that conical portion of pulp in the apical region until the full length of the root is reached, or else it retains wide open pulps until the full length of the root is formed; consequently, as he has shown you, in the apical region, we have the most complications in the formation of dentin, and in that region also we have the most complications in the deviations of the pulp chamber, and the relation of dentin and cementum.

If you prepare specimens, as has been done by a number of people, and study the forms of the pulp canals, you will get a better idea of what you must accomplish in technic in the removal of pulps and the filling of root-canals. I believe that multiple foramina have been worked to death by dentists in their attempts to make them responsible for troubles following root treatment. As a matter of fact, I can see very little difference as to whether you have one opening at the end of the root or three or four as far as the technic is concerned.

Dr. Thomas showed the way in which a rounding off of the root is accomplished and the formation of these multiple foramina.

In the next slide we consider the question of the possibility of repair after artificial injury to the surface of the tooth root. We do not know what happens when we go in thru the alveolar process and cut off the end of a root. It is an artificial injury of these tissues, and until some one examines these tissues with a microscope sometime subsequent to the operation we will not know what happens.

Quite a number of years ago in studying this problem, Dr. Moon, now professor of pathology in the medical department of the State University of Indiana, and I, made with Dr. Moorehead's help, some artificial injuries of the peridental membrane of dogs. Unfortunately our dogs developed mange and died, but they lived long enough to show some things. So far as I know, that is the only published piece of work on artificial injuries and their repair. Only this much can be said about that piece of work: These tissues after injury respond in a physiological fashion, and in this section (indicating) you can see where the surface of that root was destroyed. The burr was carried in thru the apical region into the side of the root. In the section you will see lying against the surface of the root living tissue which is responding to physiological cell activity, manifested here by absorption in that dentin, and while I do not feel I am justified in saying anything positive beyond that point because these dogs were alive for only two weeks after injury, there are places where there seem to be beginnings in the formation of new tissues which are taking on the typical arrangement. There are new attachments of fiber formation here. There is apparently first an absorption and then the formation of new fibers as the granulation tissue becomes organized. These were injuries to roots of healthy teeth with living pulps, but that does not justify anyone in saying because a pulp is removed the same thing will not happen until one tries it and finds out that it will not.

In closing, I want to repeat the one idea that the results of scientific laboratory work are only one item in evidence, and you must be intelligent enough in your interpretation of these and your knowledge of the tissues to weigh the evidence. You must be intelligent

enough to build up the evidence that can be gathered from the whole field and use it as a basis for judgment which you will apply in every case to govern your practice. (Applause).

Dr. L. H. Arnold, Chicago: Following the statement just made, some facts loom large bearing directly upon the fad of extracting all teeth not containing healthy pulps.

While it is very true that this pernicious fad is largely a *medical* fad and in a slight measure justifiable from that point of view, since, of course, cases coming under medical observation are always the badly filled roots, and the physician's limited knowledge of dentistry and its possibilities does not enable him to determine whether or not a root can be successfully filled, therefore, as just mentioned, this pernicious fad is somewhat excusable from a physician's point of view.

But for a dentist to take that attitude there is no such excuse.

Happily, his fad finds little encouragement among the better men in the Illinois State Dental Society.

Dr. Moorehead and Dr. Noyes have instructed us that two similar cells, under similar injury will not necessarily react in an identical manner. This being the case, the cells surrounding a pulpless tooth cannot be depended upon to always act in the same manner.

Cells surrounding one pulpless tooth may respond to the stimulus of infection by increased activity in walling off the infected area and the pulpless tooth may remain quiet for years doing good service and causing no whit of injury to its host, but benefiting him greatly instead. This condition every observing dentist who has practiced for any length of time has seen and can vouch for.

The cells around another pulpless tooth may not respond similarly, but simply, because *some* teeth are not safe in the mouth is no reason for adopting a fixed rule of extraction for every pulpless tooth encountered. Such a course is the practice of charlatans and tyros—not of scientific, experienced and thinking professional people.

Therefore, let us rather make it a practice to extract only such teeth as diligent, conscientious and persistent effort have proven conclusively to be beyond our present ability to put in wholesome, safe condition.

THE CONTINUOUS GUM DENTURE

By DAYTON DUNBAR CAMPBELL, D.D.S., Kansas City, Missouri

(Read before the National Society of Denture Prosthetists, Boston, Massachusetts, August 20, 1920)

JUST why dentists generally take it for granted that a patient wants vulcanite dentures, and why they proceed to construct these without ever suggesting that there are dentures of superior merit, is still one of the enigmas of dentistry. Not all patients, in fact, few patients in these days, come to the office wearing jeans or calico, yet the majority of dentists insist upon their patients wearing "jeans" or "calico" dentures. Perhaps the dentist's lack of enthusiasm with reference to the superior merits of continuous gum dentures is due to the fact that he is not aware of their superiority, and consequently does not appreciate their real worth. He has no continuous gum case to show his patient and is unable to talk intelligently about it; while vulcanite is also continuous gum, if it be placed along side of porcelain, the difference is self-explanatory. He refrains from the attempted construction because he thinks that it is a difficult undertaking, when the truth is that the construction of a continuous gum denture is not as difficult as the making of a porcelain jacket crown; it is not even as difficult as the construction of a vulcanite denture. Let instructions be given to two novices, one of them undertaking to make a vulcanite denture, while the other gives his attention to continuous gum, and the latter will be less prone to make mistakes and will be more apt to get commendable results.

While the technic involved in construction is comparatively simple, the platinum base porcelain gum denture is the highest product of prosthetic skill. It offers opportunity for the exercise of artistic taste and talent, shows appreciation of the aesthetic, and contributes in almost unlimited measure to the sense of well-being that is innate in the human soul. The materials of which it is constructed are all of mineral origin and consequently more enduring than dentures which depend upon the vegetable world. While even the best porcelain is porous, proper treatment when the case is finished renders it impervious to the fluids of the mouth.

The impression for a platinum base should, as in the case of other impressions, avail itself of the full advantages of all those factors contributing to the best possible retention. The Spence cast is poured in the usual manner, subsequently varnished over the entire surface, and an inter-locking sectional impression is made of crown and bridge investment, for pouring the metal die. Figures 1 to 5 show the sectional impression.

The writer prefers to pour the metal die and swedge the base after the method of Dr. O. H. Simpson of Dodge City, Kansas. In preparation for this, the border of the sectional impression along the side which determines the thickness of the die is trimmed down to a suitable height and leveled upon a sheet of sandpaper placed upon a smooth surface. After polishing the inside surface with soap-stone and then removing any excess of this polishing material, a flat piece of

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resisto asbestos board is laid upon the flat surface and held in close contact by means of a clamp or piece of copper wire (Fig. 6). When this has been allowed to dry out thoroly over a slow heat, Haskell's babbitt metal is heated in a ladle and poured, care being taken to avoid pouring while too hot. If the pine stick used in stirring becomes charred, the metal is too hot. The sectional impression is placed upright, resting upon the anterior portion, while the metal, in a slightly granular state with a tendency to congeal, is poured into it and tamped lightly with the square end of the stick; it is allowed to remain standing until crystallization has taken place. When the mould is opened, any excess is removed and the die polished with pumice.

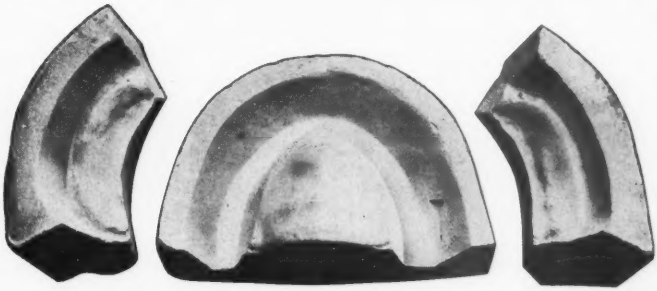

Fig. 1

Figures numbered 1 to 5 show different views of the sectional impression.

In order to cut the platinum plate without unnecessary waste, No. 60 Gauge tinfoil is adapted to the metal die, and trimmed to size as if it were to be the base—allowing perhaps a millimeter excess along the entire periphery and an additional eighth of an inch along the posterior border. This outline is placed upon No. 32 Gauge platinum, which is cut, placed upon the metal die, and with

Fig. 2

Fig. 3

horn mallet and hardwood burnishers adapted. In cases of deep vault it is often necessary in the region of the cuspids to split the platinum at the buccal border and extending over the crest of the ridge; this secures adaptation without a tendency to buckle.

In the construction of the counter-die,

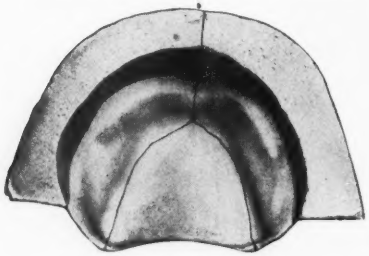

Fig. 4

the die is oiled thoroly, placed in the bowl of the putty swedger (Fig. 7) and a bulk of medium-soft modeling compound forced against it, after which the plunger is placed upon the compound and tapped lightly with a hammer to insure close adaptation. When the compound is thoroly hardened, the die is

Fig. 5

forcibly removed by inserting a pointed instrument along the posterior border.

The platinum base is now put between die and counter-die and swedged. (Also shown in Fig. 7). After removing, any excess platinum is trimmed away, the case returned to the Spence cast and swedged upon it, a piece of rubber-dam being used to keep the putty from getting between the base and the cast.

For reinforcing the periphery, No. 18 Gauge iridio-platinum wire is used as follows: The platinum base is imbedded in crown and bridge investment, leaving exposed near the heel and border a surface about three-eighths of an inch wide. Starting with a free end an eighth of an inch in length on the palatal side

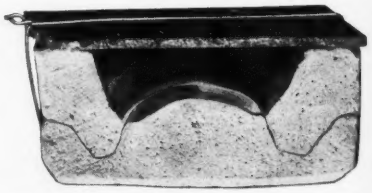

Fig. 6.—Sectional impression ready to pour with Haskell's die metal.

of the crest along one tuberosity, this wire is contoured and just below the crest of the ridge is tacked with a bit of rhotanium (Fig. 8). Rhotanium,

Fig. 7.—Schematic drawing, showing position of plunger, modeling compound, counter-die, platinum and metal die.

a substitute for platinum, has a melting point 200 or 300 degrees below the melting point of pure platinum. It is

preferred as a solder instead of gold or hard platinum solder, because it may be used in building up contours and for filling in spaces. By holding the wire with one hand and the blowpipe in the other, the wire may be contoured to follow the border without the use of pliers. It is tacked at intervals determined by the degree of turn that is followed, removed from the investment and the soldering then completed. Excess solder, which, because of its bulk prevents the base from seating upon the Spence cast, is removed; the base is now

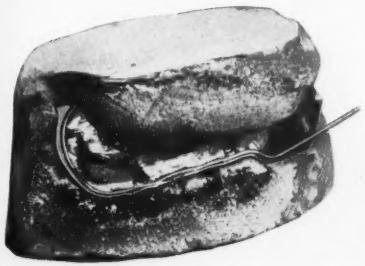

Fig. 8.—Showing method of holding the stiff iridio-platinum wire so that it may easily be contoured under heat of the blowpipe.

seated and again swedged in the putty swedger.

After this swedging, and before removing from the cast, the posterior border of the base is strengthened. In this process, along a line drawn across the platinum and over the crest of the ridges to mark the desired length of the base, a surface of compound is built up, to give a clear-cut edge at right angle to and against which the base may be turned along the posterior border (Fig. 9). While holding the case firmly in place, the operator inserts a knife blade under the edge of the platinum, and exercising care to avoid splitting or breaking the platinum base along this border, it may be forced up against the compound. When the compound has been removed, a ball burnisher is used to burnish down the raised portion, thus providing a double thickness of platinum at the posterior palatal border. The base is now taken from the cast and the turned edge soldered with rhotanium along its entire length. This doubler may be left as wide as the operator may deem best, but the writer has found that a sixteenth of an inch is sufficient.

When this strengthener has been finished, the case is returned to the Spence cast and the wax bite rim adapted. The

Fig. 9.—Showing use of black compound to provide a sharp line against which the platinum may be turned in strengthening the posterior palatal border.

bite is taken, and the teeth arranged in the same manner as for any other case; with the teeth in position, the case is again put upon the Spence cast, along the border of which notches are cut to assure compact re-assembling of the matrices, which are now poured of plaster.

The base is sealed to the cast, care being taken to keep the border of the cast and the gingiva of the teeth free of wax. The matrices are poured over the occlusal and buccal surfaces of the teeth, extending to the bottom of the cast; for purposes of convenience these are poured in three sections. After removing these sections, the teeth are

boiled in water to thoroly cleanse from wax; the platinum base is cleansed by burning off in the flame.

With the base in position upon the Spence cast, the sections carrying the teeth in their impressions, are assembled, and, if necessary, each tooth is ground sufficiently to permit insertion in the diatorics of No. 16 Gauge iridio-platinum wire. In the case of alloyed pin teeth, the pins are cut off flush with the porcelain, and a No. 234 mounted carborundum stone is used to grind out the stumps in such manner as to leave a concave surface in the ridge-lap portion of the tooth (Fig. 10). The writer prefers to remove the glaze from the teeth with hydrofluoric acid; any roughness due to etching is removed with a medium grit garnet disc.

Fig. 10.—Showing (from left to right) tooth as received from manufacturer; tooth with pins ground off even with the porcelain; carborundum stone No. 234 used in grinding out remainder of pins; tooth ready to receive iridio-platinum wire pin and porcelain; finished tooth ready to be attached to base.

The teeth fitted with wires of proper length are assembled in the matrices upon the base, and each of the wires attached to the platinum with a drop of wax. Body porcelain is packed around the wire and in the hole of each tooth, while the tooth is built down to touch the base. With a chip blower the drop of wax is melted and blown away, the section is taken from the cast, each tooth removed from its matrix, the excess is brushed away, and the porcelain then fused around the wire, holding it in correct position.

When the pins have been baked in the teeth, they are re-assembled in their matrices upon the cast as shown in Figure 11 for the purpose of marking the position of No. 16 Gauge iridio-platinum truss or reinforcing wires, which should be placed at every point where there is danger of the base bending under stress. A stronger result is secured if these wires are not permitted to lie in contact thruout their length; it is better to employ points of contact at the ends and upon the crest of the ridge, in which case they serve as suspension braces. Finally, one is contoured to the border of the base over the labial frenum, extending a half inch on either side (Fig. 12).

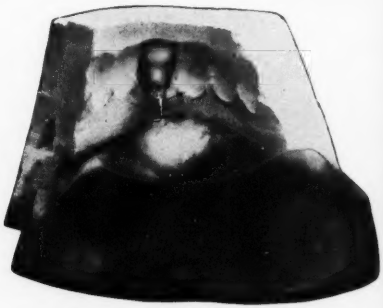

Fig. 11.—Anterior sectional matrix, showing how the prepared tooth with pin is held in correct position.

The case is now re-assembled on the cast, and the teeth stuck to the base with wax. The matrices are removed, and the base, carrying the teeth in position, is removed from the cast for investing preparatory to soldering. The investment fills the base and entirely covers

the teeth, leaving exposed only the wax which holds the teeth. After the investment has set, this wax may be removed with boiling water; the exposed portion is then covered with thin investment applied with a camel's-hair brush, and as soon as set the portion around the junction of the pin with the platinum base is washed out. Pieces of No. 32 Guage rhotanium about one-sixteenth of an inch square are forced between the iridio-platinum pins and the base. The whole case is put over the flame and

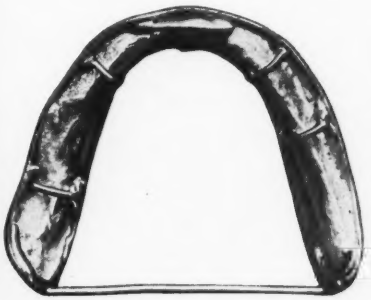

Fig. 12.—Lower base provided with reinforcing iridio-platinum wires.

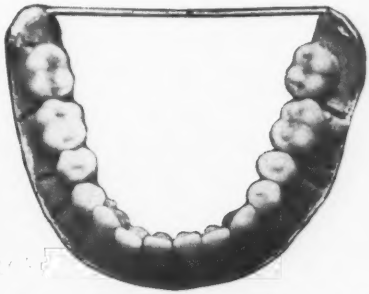

Fig. 13.—The lower base after the first bake, showing lines of cleavage used to restrict shrinkage to the individual teeth.

heated to a cherry-red when, with an oxy-hydrogen blowpipe, the pins are soldered to the base. In the case of the lower, before assembling the teeth preparatory to soldering, a length of No. 16 Gauge iridio-platinum wire is soldered from heel to heel slightly below the crest. This is done as a precaution to prevent warping, and the wire is allowed to remain in position until the denture is finished (Figs. 12, 13).

Any investment that may have been fused to the porcelain during the soldering process is removed, since it is absolutely essential that all foreign material be removed, to avoid gas bubbles while baking. Wherever possible, small pieces of baked porcelain are gently inserted between the ridge-lap of the tooth and the platinum base, in order to prevent any subsequent movement of the teeth.

The case is now ready to receive the porcelain; the procedure and technic are as old as the continuous gum denture itself. "Allen's Continuous Gum Body Porcelain" is used in conjunction with "Close's Gum Enamel Porcelain." The body porcelain is mixed with distilled water to a thick creamy consistency and applied with a spatula to the base and around the teeth, and in order to pack it, the base is fiddled with the same instrument. The porcelain is built up to full contour desired, no cognizance being taken of possible shrinkage. When built up, the porcelain is trimmed around the gingiva and the labial border of the teeth. With a piece of matrix metal it is cut thru to the platinum base between the teeth. In cases with extreme distance between the base and the teeth, it is advisable to make an additional cut about an eighth of an inch below the base of the tooth, and running parallel with the ridge. This method of cutting helps to determine the course of shrinkage around each individual tooth. With spatula and brush, the saw-edges are practically obliterated and when fused down leave a smoother surface.

The base, with both heels and the

anterior portion of the periphery, as well as the posterior border of the palate touching the fire-clay slab, is placed in the furnace and gradually brought up to the fusing point of pure gold; this constitutes the first bake and it should result in a rather high glaze. It is safe to remove the case immediately, provided it is placed under a cover glass, and it will cool more quickly here than in the furnace. When cool enough to permit handling, it is forced into place upon the cast, and if warped it may be necessary to break away the porcelain sufficiently to permit the close adaptation desired. When removed from the cast, the grooves are packed with porcelain and the contours built up wherever required; it is again placed in the furnace and baked and then cooled in the same manner as at first.

When the body porcelain has been supplied and finished as desired, gum enamel porcelain is mixed with distilled water and a coating about a millimeter in thickness is applied, but this is scraped down thin at some points in order to give the desired shadings. A contoured gingival border is produced thru placing a drop of water upon the pink porcelain at the gingiva of each tooth and then, with a short flat camel's hair brush pressed against the tooth, pushing back in a roll the porcelain that over-lies the cervical margins. The denture is now placed in the furnace and baked with approximately the same degree of heat as before. This is determined by looking into the furnace and observing the oily appearance which characterizes the surface while fusing. This time it is left in the furnace until cold, in order that it may temper properly and consequently have the desired strength.

In removing the thin layer of porcelain that may have encroached upon the border, garnet discs are used, and the platinum is then given a high polish.

The denture is now placed in a pan of hot stearine and boiled until bubbles no longer arise. It is then removed and the stearine wiped from its surface. This boiling is necessary because of the porosity of the porcelain, and the fact that there is no absolute union between it and the platinum; the stearine fills pores and spaces, and since its boiling point is sufficiently high, nothing that is taken into the mouth will melt it.

This method of rendering the continuous gum denture sanitary is, so far as the writer is aware, a new one, and is probably the only new feature presented in this paper.

ANNUAL REPORT OF ORAL HYGIENE COMMITTEE FOR THE STATE OF MICHIGAN

By HERTHA C. HARTWIG, D.D.S., Chairman, Detroit, Michigan

(Read before the Annual Meeting of the Michigan State Dental Society, April, 1920)

IN PREPARING this report, the Committee on Oral Hygiene has endeavored to ascertain what is being done in the state of Michigan, compare it with what is being done in other parts of the country, point out our excellencies and deficiencies and attempt to recommend some remedy for the existing deplorable conditions. The Committee has sent questionnaires to the secretaries of all the districts in the state and to any other persons whom it was thought possible could furnish us with the necessary information. To save time and labor, we have decided not to give reports in full, but choose the most important points. All data and correspondence have been carefully filed for reference. The questionnaires dealt with the most salient features of oral hygiene work; the quantity accomplished, type of work done, how financed, equipment, rural communities served, etc. If we have failed to mention worthy service rendered in any part of the state, it is because we have not been duly informed of it. If there be anyone in this audience who knows of such service as is not mentioned, let him please come forward after the meeting and notify the committee. And that is one of the striking things brought to light, the utter lack of co-operation between the various groups and individuals in the state, tho be it understood, not thru any fault of their own. It has never been taken up as a state issue. When I was first made chairman on this committee last April, I hadn't any idea who was directing the work here or what was being done until I went to New Orleans, to the National, where I was introduced to Dr. Thompson. We were mutually pleased we came from the same city and mutually astonished each to find out who the other was.

Various members of the committee have visited the school for hygienists at Columbia University, talked with men who are leaders in the hygienist movement, visited the schools at Bridgeport and interviewed Dr. Fones, the enthusiastic director of dental activities there. We also visited the prophylactic clinic of the Metropolitan Life Insurance Company in New York, under the control of Dr. Thaddeus Hyatt. At the recent state meeting in Chicago, one of the committee went over for the first day of the meeting, the big dental health day, with such men on the program as Drs. Dittmar, Logan, Black, Dr. Burkhart, of the Eastman Dispensary, Dr. Fones, Dr. Robertson, the Commissioner of Public Health of Chicago, Mr. Mortenson, Superintendent of the schools, and Dr. Evans, Health Editor of the *Chicago Tribune*, all of whom are vitally interested in the oral health movement.

We have gleaned magazines and public prints for reports of the movement all over the country. We have been supplied with data from many sources and desire to thank our many correspond-

ents for their valuable information and also the people whom we have interviewed personally. All reports and other information have been boiled down considerably.

First, we will review the oral hygiene movement in some of the states outside our own.

In Los Angeles, California, a committee of women dentists started a dispensary in Juvenile Hall, a detention home for boys and girls. The work given the greatest consideration is preventive work, including prophylactic treatments, toothbrush drills and educational measures. Every child is given a toothbrush, which is then marked with his name and number. So that they may not become lost, all the toothbrushes are hung, sufficient distances apart for sanitation, in a long box fastened to the brick wall. The lid of this may be raised to expose the brushes to sun and air. The children brush their teeth at a long trough-like sink, where all the faucets are controlled by one key, with which the water is turned on at brushing time.

In Kansas, a law has been passed, making it compulsory that the teeth of every school child be inspected annually, unless he can present a certificate from a legally qualified dentist stating that such examination has been made by him. The co-operation of the teachers is wonderful. They have a long chart to fill out, in regard to the general condition of the child, as much as can be ascertained from a cursory examination. On this chart are recorded, by the teachers, age, height, weight, mental condition, general physical condition, appearance of the skin, condition of the eyes, ears, mouth, nose, throat, teeth, neck, any information about pain, headache, toothache, indigestion, etc. Then when the dentist comes he fills out the rest of the chart with accurate, specific information concerning teeth, mouth and gums.

In Ohio they will soon have a law requiring inspection of the teeth of school children.

In 1915, in Cincinnati, a mouth hygiene educational week was attempted, lectures were given at every school; public meetings were held before improvement societies, parents' clubs and mothers' clubs and a special teachers' meeting was called, at which there were prominent speakers. At the end of the campaign, practically every child owned a toothbrush. However, it was a failure, because there was no follow-up work.

Ten years ago the late Dr. Ebersole tried out an experiment in Cleveland, where by using an ordinary class for a control and choosing a certain other number of the worst students for treatment, he proved conclusively the definite health relation between the teeth and the mind and body. The children in the class treated improved so remarkably both physically, mentally and even morally, that no doubt could remain in anyone's mind.

Some years ago the Illinois State Dental Society decided to give to the public of the thirty largest cities in Illinois illustrated lectures and instruction in mouth hygiene. Consequently, a committee was appointed with splendid men on it who traveled all over the state. The attendance at these lectures was most gratifying and the report of the chairman of the committee testified that great good had been accomplished. However, these lectures had to be discontinued for lack of financial backing.

A few years ago the Health Department of Chicago published monthly a magazine devoted to instructing the pupils of the school systems in the care of the entire body. There was a splendid dental department in it. It was financed by a liberally disposed retired capitalist and when he withdrew his money support, of course the magazine stopped. If Chicago had understood its obligations to humanity, it would have

instituted a similar magazine and carried on the work.

In South Carolina, they have a dental ambulance for rural communities. In Tennessee, Dr. Allison Buckner was appointed by the State Board of Health as the director of the Bureau of Oral Hygiene. He has authority under the law to appoint in each county a reputable dentist known as a county mouth hygienist. There county hygienists work without compensation and in conjunction with and under direction of the Bureau. The director during the school term, visits each county and in company with the local hygienist, visits the schools, lecturing and instructing. Tennessee is large, has ninety-six counties and in such counties as the director is unable to visit, the local county hygienist is expected to carry on the work. Dr. Buckner desires it distinctly understood that the fact that some one man is designated in each county does not preclude the possibility of other members of the profession aiding in the work. In fact, he desires the earnest co-operation and support of the entire profession.

From West Virginia, Major H. B. Butler writes: "I am engaged in mouth hygiene work under the child welfare branch of the public health service; have the only unit out at present; am operating in West Virginia. We lecture, examine and chart, carry 4,000 feet of new film, a complete portable outfit, demonstrate highest type of prophylaxis and have 5000 brushes and tubes of paste. We find some conditions beyond conception, quite a bit of Vincent's Angina. With us, oral hygiene is not a tooth proposition, but a matter of sanitation for a community. We endure some hardships, but it is a work well worth the sacrifice of comfort and we are making good.

"Any journal, articles, papers, etc., will be a Godsend to me as we see none whatever.

"Am spending all spare time on series of stories for children and they are good for they are children's ideas and trying them out has proven their worth."

And we are inclined to consider the South "backwoodsy."

The government also sends out thru its public health service, Dr. Herdliska, who has, as an illustration of dental health, a three-reel film on the care of teeth, called, "Come Clean." It is extremely interesting and instructive, a story of the dental troubles of an American boy, who wants to become a soldier, but is rejected because of his bad teeth. He is eventually fixed up and goes to camp. His entertaining experience there convincing his jeering camp mates the value of mouth care, makes it as exciting and amusing a film as any in our movie houses. There is a fine fight in one part.

Vermont has the honor of establishing the first system of rural dental clinics, which is regarded as the ideal method for rural communities. The work was taken up under the supervision of Dr. Earle Johnson, about two years ago. The equipment consists of a car and portable army dental unit; $10,000.00 was at that time procured thru the generosity of private individuals, in order to try to get enough public sentiment aroused in favor of oral hygiene to assure them of an appropriation from the state.

Mr. W. J. Multer, principal of the Roslyn schools, Nassau County, New York, is heading a movement under the auspices of the Red Cross which has provided a mobile dental clinic for the school children of his county. Dentists have co-operated wholeheartedly, as have also school teachers and children. Equipment for five dispensaries and material used to give illustrated talks on oral hygiene are conveyed from school to school in dental education cars. The equipment, including chair, engine, instrument case, stereopticon outfit, etc., may be purchased for less than $350.00.

Surely Michigan counties can afford $350.00.

The educational feature of the project is becoming most important. Besides giving illustrated talks to parents and children, pamphlets and blotters are sent into the homes by means of the children attending school. There are five dentists working, one for each unit.

I have had considerable correspondence with Mr. Multer and also the Red Cross authorities at Washington. Mr. J. N. Rule, the national director, sent a copy of one of my letters to Chicago, and as a result Mr. Walter Davidson there, assistant manager at the Central Division Headquarters, is coming to Detroit early in May for a personal interview, for the purpose of discussing a possible plan of co-operation between the Michigan State Dental Society and the Red Cross in establishing some such traveling clinic as the one operated in New York. It would be well for all those interested in this project, to also meet with Mr. Davidson in a general conference.

Very little is published or known outside the profession, and inside for that matter, about the Eastman Dental Dispensary at Rochester, New York, the Forsyth Dental Dispensary at Boston, and the splendid work they are doing. More should be known of these monumental institutions so that the magnificent movement inaugurated by Mr. Forsyth and followed by Mr. Eastman, may be duplicated in other cities. There must be some Mr. Forsyths or Mr. Eastmans in this state, who need only to be awakened to most willingly and eagerly contribute to the progress of one of the greatest movements in history.

In New York City, student dental hygienists from the department of Oral Hygiene of Columbia University, are at work with the dental staff in cleaning and caring for the teeth in the downtown Italian district.

From various educators in New York state, come commendations of mouth hygiene work. We will quote parts from only a few letters. The Superintendent of schools of Elmira writes in part: "No boy or girl who is given the privilege of attending one of these lectures can plead ignorance for not taking proper care of the teeth. These lectures supplement and greatly strengthen the teaching of the subject in the schools. Every state in the union should have a lecturer on mouth hygiene. The amount of good accomplished would be out of all proportion to the expense involved."

From the letter of the principal of Lyons Union School: "Coming from a state official, these talks have a somewhat greater weight with the scholars than the same instruction does when brought by the teachers." The same opinion is expressed by the Superintendent of schools of Hudson, New York: "Coming as they did from one outside of the city, these lectures produced a strong impression upon the minds of the children and were productive of much good. I sincerely hope that you will be able to secure some similar system in Michigan."

The Superintendent of Troy, New York states that: "As a result of this examination, sufficient evidence was at hand to demonstrate to the financial authorities of our city that a dental clinic should be established for indigent and needy children. We have accomplished an untold amount of good by means of this clinic, and many who were aenemic and nervous and consequently troublesome in school have, by reason of the care given to the teeth, very greatly improved their application, as well as behavior."

The Superintendent of Auburn gives as his opinion: "Back of all law there must be popular intelligence, for no law is effective that does not have a strong public sentiment back of it. The only way to create this public sentiment is thru public education."

The Superintendent of schools in Oneonto concludes his letter thus: "To what end is it to provide expensive

buildings and teachers and elaborate courses of study if the children, who are assembled to enjoy these opportunities, are not in a suitable condition, physically, to receive instruction?"

There were many such letters, which we have on file for anyone who is interested.

The Metropolitan Life Insurance Company in 1917 paid principals to beneficiaries of 52 industrial policy holders, whose deaths were directly traceable to an unhealthy and infected condition of the teeth and gums. In the home office, there was so much absence from minor illnesses, that, convinced that bad teeth had much to do with it, the directors installed a prophylactic clinic under the direction of Dr. Thaddeus Hyatt. Dental hygienists give the prophylactic treatments. There is no tooth cleaning with the engine. Every employee is compelled either to undergo examination and treatment twice a year or forfeit his position. Only those are excused who have been examined and treated by private dentists. A dentist also is employed who does X-ray work and gives emergency treatments. Dr. Hyatt does all the lecturing. The work has proven a wonderful success. One of the nurses told me that one woman, who had been absent every few weeks from headaches, indigestion, etc., after having her mouth cleaned up, received the bonus that year for perfect attendance.

Did you read the fine article entitled: "Teeth and Scholarship" under the department of "Everybody's Business," in the *Saturday Evening Post* for March 27? Dr. Hyatt is quoted thus: "New York City has spent $177,000,000.00 in providing pure water for its population. This was done to insure the community against undue illness and prevent a lessening of business enterprise due to time lost thru sickness.

"The metropolis also spends $100,000 annually for the inspection of meats and other foodstuffs. But before these supplies of pure water and food can enter the stomach they must pass thru and be mixed with the contents of the human mouth. Unclean table and kitchen utensils are less dangerous to the purity of the food than an unclean mouth. It is foolish to spend millions of dollars to safeguard the things we eat and drink, and then ignore the health and sanitation of the final chamber in which these things are mixed before they enter the stomach.

"Many cities spend millions of dollars in the education of children. In New York it costs forty dollars to educate one child for one year. If a child fails to be promoted, this pupil becomes an added expense to the taxpayers. More than ninety-five per cent of the children, who are kept back thru failure to pass their examinations, are suffering from defective teeth and an unhygienic condition of the mouth. It is estimated that the cost of the city of New York alone for these held-back children has averged more than three millions of dollars annually for a decade. In one Brooklyn school, where more than two thousand children were examined, the records showed that in the room which had the largest number of cavities per child, and in which the general mouth condition was bad, every child had failed to pass the last examination."

In New Zealand they are refusing to take any appropriation less than $500,000.00 and have so informed the Minister of Finance of Great Britain. They are training their own dentists to help in the work of taking care of the children of pre-school age and also up to 12, under the direction and control of the state.

Everyone should read in the *Dental Cosmos* for June, 1919, the report of the Royal Commission of Dentistry of Great Britain. It is very lengthy, but contains much food for thought. We will quote some of their findings.

The testimony from sickness benefit insurance societies leads them to the opinion that "there can be no doubt that

thousands of persons receiving sickness benefit, would not be doing so had they received proper dental attention." Also that a "large amount of preventable sickness and chronic invalidity terminating, in many instances, in premature death, result from the effect of oral sepsis and decayed teeth."

"In Great Britain, grants are available for expenditures on a clinic for expectant and nursing mothers and for children under five years of age. The committee states that expectant and nursing mothers should, perhaps, more than any other sections of the community, have teeth in such condition that they can properly masticate their food. There is evidence that the advantages accruing from school dental inspection and treatment, would be greater if the children came under dental treatment before school age."

Further: "Expenditure on dental treatment for T. B. C. patients if often imperative in the interests of the patient, but the committee observes that this is expenditure which should in course of time very greatly diminish, when adequate dental treatment of children and young adults is provided. It furnishes an excellent example of how the neglect of the state to provide a preventive dental service for its young citizens leads later on to the state needing to intervene to give its adult citizens an improved prospect of recovery from a fatal disease. T. B. C. is a disease, moreover, which many competent authorities regard as favored by the conditions resulting from neglect of dental disease."

And let me say all these facts are true of a great many of the preventable diseases.

The report of the Royal Commission ends thus: "In conclusion, we wish to state very strongly that, in our opinion, the state cannot afford to allow the health of the workers of the nation to be continuously undermined by dental neglect. Steps should be taken without delay to recognize dentistry as one of the chief, if not the chief means for preventing ill health, and every possible means should be employed for enlightening the public as to the need for conservative treatment for diseased teeth. The dental profession should be regarded as one of the outposts of preventive medicine and as such, encouraged and assisted by the state," etc.

France has the correct idea in regard to this movement—publicity. The campaign to educate the public in the care of their teeth has been instituted thru the military department. Short, clear statements are inserted in all French publications to the effect that: "While France has lost heavily in life and property, all can be speedily regained if the adult and youth life quickly regain complete health and this is accomplished quickest by a clean mouth and perfect teeth. Consult your dentist or your physician. If unable to pay for such service, communicate with the Bureau of Health, Military Department, Paris, France."

The government is placing in all cities, villages and along public highways, large posters in colors, which have instructive reading matter on them, telling the particular advantage of mouth care to the boys and girls. By this method, the French government has taken a direct and active part in the upbuilding of humanity and eliminated the personal advertisement, which is the cause of so much intense criticism.

We will return once more to this country and consider last, of the places outside the state, Bridgeport, Connecticut, which seems, in the oral hygiene movement, the model city. It is a city of 180,000 inhabitants, has 23,000 school children and this year their appropriation is $42,000.00. If you could just once visit their schools and observe the effect of this work on the children, you would almost burst with enthusiasm. I can't begin to tell you all the inspiring sights I saw. Just briefly to review. Dr. Fones is, of course, the guiding spirit and advisor. He directs the work. A

woman, herself one of the first graduate hygienists, supervises it. In each school there is a dental outfit and a hygienist, who stays there nearly all the time. Only the children in the first five grades are cared for. By the time they reach the sixth grade they are supposed to have the habit. The presence alone of this woman gowned in white, has its psychological effect on the children. She is indelibly associated with their toothbrushes and suggests cleanliness. There are also three women dentists, filling small cavities in the six-year molars for the first and second grades. Also a dentist in the municipal clinic, who does emergency work.

There are four distinct parts to their system. First, the prophylactic treatment (not done by a brush wheel on an engine, either) and chart examinations of the mouth. Second, toothbrush drills and classroom talks. Also lectures on proper foods and how to eat them. Third, stereopticon lectures and fourth, educational work in the homes by means of special literature for parents. Two different child's books on teeth are used as readers and the upper classes have lessons in pamphlets like the ones sent parents. They then can explain these to their parents.

As Dr. Fones says, "It will take a long period of public education before the mouths of the incoming children to the first grade will show any great degree of improvement. From birth to five or six years, they are entirely under the home influence and are permitted to eat foods, especially sweets, that are conducive to decay and mouth cleanliness is not compulsory. Slowly, but surely however, the public school education will seep back into the homes and, with the aid of the older children and pamphlets, it is our hope that, eventually, the mouths of these tiny children, too, will present a much improved condition.

The children of the fifth grade, who had never had the advantage of prophylactic treatments, toothbrush drills and education in mouth hygiene, were chosen as a control class and compared with the present fifth graders at the time of the report, who had had all these advantages for the first five years of their school life. They had had no repair work provided for them and the preventive work was three-fourths educational.

One school showed a reduction in caries of 67.5%. Some schools were very bad, so it brought down the average reduction to 33.9%. Dr. Fones said: "The elimination of dental decay is so dependent upon factors other than cleanliness and education in mouth hygiene that it is surprising to note the large reduction in many schools. The most important factor is that of diet, and cooperation in this matter can be secured only after many years of education. The correct feeding of a child from birth to twelve years would, in itself, partially, if not wholly, eliminate dental decay." Nowadays we seem to be living on luxuries, not necessities.

Retardation or re-education of children failing to be promoted was cut down 50% on an average. Think of it! If the number of children in the schools remained the same, the school budget could be cut 50%. Just cut in half.

Death rates of diphtheria, scarlet fever and the measles, usually thought of as children's diseases, were appreciably lessened. Death rate of the influenza in Bridgeport during the great epidemic was 5.2% per 1000, the lowest record of any city approaching its size. The city health officer attributes this not only to the educational campaign which he inaugurated, but to the intelligent background for that education given by the regular work of this clinic, both in caring for the mouths of the children and in instructing them and, thru pamphlets, their parents.

And these results were obtained during war times in a city of large foreign population, mostly making munitions,

which population was ever shifting, making difficult the follow-up work. Principals, teachers and pupils were constantly engaged in drives of one kind and another and other war-time activities. It showed what could be done even under the most adverse conditions.

Now we come to our own state, which we will take by districts.

Second District, Jackson.—The Secretary informs us that they have in Jackson a dental surgeon, a physician, a nurse and teachers all co-operating in the work, with card notification to parents and a follow-up system. Dr. Russell Curtis has charge of the clinic, which is financed by the city. They have a complete equipment and do both reparative and preventive work. There is not much being done in an educational way. The surrounding rural communities are examined by a nurse, who sends notifications to parents.

Second District, Ann Arbor.—In Ann Arbor a great number of the children go voluntarily to the college infirmary, but examination is carried on in the schools by Dr. Fisher and work done for the children thus sent by Dr. Vedder, on Saturday afternoons, in the college infirmary.

Third and Fourth Districts, Kalamazoo.—Dr. P. D. Crum writes that several years ago the board of education employed a dentist to spend half his time in the schools and would have continued that arrangement but were unable to get a dentist on account of the war, so at the suggestions of the dentists, they employed a graduate dental nurse, who examines and cleans all the children's teeth from the kindergarten thru the fifth grade. This is her second year and she has been doing very good work. Each dentist in the city devotes one hour a week in his office to the worthy poor children who are assigned to the dentists and brought to their offices by the school nurse. The dental hygienist gives instructions in brush and home care of the teeth and notifies parents as to number of teeth needing attention. Kalamazoo shows the effects of its home product. 44% of six year molars were sound and only 3% extracted. The children must all eat the celery in that town. And it is a sanitary place too. Of the 1945 children examined, 1460 used their toothbrushes, 334 possessed the moral support which comes from at least owning one, even if it remains unused, while only 151 had no brushes at all. This year stereopticon lectures are given and the reader, "A Child's Book of the Teeth" has been placed in each school library for the use of the children. It ought to be in every room at least.

Third and Fourth Districts, Battle Creek.—Dr. Bertha Olsen has charge of the work in Battle Creek, which just started December 8th last. Up to date she has done it all herself. She receives a salary from the school board for devoting half a day to the school service, while various local dentists have offered voluntary assistance. The equipment as yet is incomplete, consisting of a dental hygienist chair, engine, sterilizer and a full set of prophylactic instruments. The work so far is simply preventive. Educational work has been conducted largely thru the aid of the teachers and school nurses, plus her own efforts. In the "All School Exhibit" which will be held the latter part of May, the dental department will be represented so as to bring before the public a more intimate understanding of the need of this work.

Third and Fourth Districts, South Haven.—From South Haven we have the report that some work is being done by men of ideals. This work is voluntary by dentists in the city and is preventive in nature, done in their offices. There is no equipment at the schools, but the mouths of the children are examined there. There are educational lectures, both in the South Haven schools and in the school houses of the surrounding rural communities.

Fifth District, Grand Rapids.—Dr. H. B. McMillan writes: "As to honest

and truly oral hygiene we are sadly lacking. We clean each child's teeth as he enters the clinic and instruct him as to how and how often to brush them, but this is not followed up, in the true sense of oral hygiene.

"We need true oral hygiene in all classes of our schools and we pray the good Lord will send us dental nurses and send them quickly."

As you have heard, there is a limited amount of work in the schools of Grand Rapids. It is in charge of two dentists, Dr. McMillan and Dr. H. F. Van Dreyer, paid by the health department of the city. The report does not state whether they are full time or part time men. They have the usual school equipment. The children are examined and given reparative service. The report states there is preventive work, but not in the true sense of the term—there isn't time. There is no educational work further than what the examining nurses give and the dentists give upon visitation, which isn't much.

Rural communities are taken care of by the county, but as they have no connection with the city, the extent of the work is not known.

Fifth District, Muskegon.—In Muskegon they have a school dentist, Dr. R. E. Vanderlinde, and nurse, paid by the school board, who examine all pupils twice a year and advise what should be done. They have a complete dental equipment at one of the schools for the deserving poor children. The type of work done is prophylactic and restorative. Educational work is limited to a few talks by the school dentist. The rural districts are not looked after by the city. Probably neglected entirely.

Fifth District, Holland.—The work in Holland is carried on at the city hospital by a dentist of the city, who gives voluntary service for one year. They have a full modern equipment and carry out examinations, prevention work and reparative such as amalgam, cement and porcelain fillings. There is no educational work of any kind nor any work done for surrounding rural districts.

Sixth District, Lansing.—In Lansing the work is rather new as in other places, having started apparently, only about 5 months ago. The city appropriated $5,000.00 for a dental clinic. One full time dentist, Dr. H. B. Fassett, is employed and the children treated free of charge just as elsewhere. Most of the work is reparative. The children are examined in the schools and given instruction as to the care of the teeth. In the past 5 months, besides examinations, 400 children have been treated. Lansing seems to have a health center with a physician director, under whom work the city physician, city dentist and clinic nurse.

Sixth District, Owosso.—Owosso has a nurse paid by the school district, who just examines the children and lectures and gives toothbrush drills.

Seventh District, Port Huron.—In 1914 clinic work was introduced into Port Huron by Dr. A. C. Thompson, now the Detroit Dental Director, and about one-half of the other dentists. They gave voluntary services in their offices which they managed thru the school nurse, a zealous and enthusiastic worker. Unfortunately in other directions there was a deplorable attitude. These men trying to serve humanity to the best of their ability were accused of promoting an advertising scheme. This, at the time, blocked any financial assistance from the board of health. Three years ago the King's daughters took it up and now provide one-half the funds. The other half is provided by the city. They have a dental director who is under the authority of the oral hygiene committee of the local society. There is a complete outfit in the high school, where they examine and operate. A little is done along the line of lecturing to educate the children.

Seventh District, Croswell.—From the Sanilac County Chapter of the American

Red Cross, at Croswell, the county nurse writes: "Dr. Thompson has suggested I write to you regarding my dental problems.

"We started school nursing the middle of November, in Sanilac County and find a deplorable dental condition existing in most schools. In many cases, conditions cannot be remedied for lack of funds, but in many more the dentists refuse to fill the temporary teeth. Is there any way whereby the State Dental Society could arrange for a traveling dental clinic and what would be the probable expense to the chapter?"

What could I tell her? Can you imagine anything worse? I suppose you can. Something like the two privates.

1st Private: "Can you imagine anything worse than having cooties?"

2nd Private: "Yes; suppose you had 'em—and they chirped."

Silence is golden.

Eighth District, Saginaw.—In Saginaw the city employes a dentist, Dr. B. W. Lathrop, for one-half day, five days per week, who does all kinds of restorative work except in gold. There is very little education in mouth health. The equipment is standard. Nothing is being done for the rural communities. That is all the information available about Saginaw.

Eighth District, Flint.—Three years ago Flint did not have even a full time physician; had one city and one school nurse, one part time dentist seeing patients in his office, referred by the school nurse. In fall of 1918 they added another full time physician and Dr. Davis as full time dentist, who with health department were to work out dental program. Provision for these two additions were made possible by the efforts of the health officer and the Mayor; the latter, Charles S. Mott, put his salary of $2,500.00 back into the treasury to add a sufficient budget. A second-hand outfit was placed in the most uninviting part of the basement of the city hall.

The first year as far as possible, they made a complete survey of mouth conditions in the grades; examined nearly 10,000 children. Did all actual clinic work possible and gave educational talks to mothers' clubs, etc. Splendid cooperation and support from health department, teachers and school nurses. In six months a sufficient showing of need and possibilities had been made so that city council and school board made provision in the new budget to enlarge work. September 1st they added two dentists and a hygienist. The city purchased a building adjacent to the city hall and remodeled it for the use of the entire health department and they now have comfortable rooms and modern equipment, three new and one second-hand. Have made a start in branching out into schools or near it from the central clinic. The budget for the coming year is approximately $15,000.00.

They make a complete examination of school children, about 15,000, once a year with mouth mirror and probe, so as to catch all pit and fissure cavities before they reach large proportions, wherein lies one of the greatest opportunities for prevention. Much attention is also paid to removal of infection by extraction.

Notices are sent to parents that children need attention. If parents are unable to afford it, work is done at the clinic. They have a splendid follow-up system, examination cards which are filed and follow the child thru school. This is believed one of the most practical features of the system. To show what results can be obtained, they have a 100% dental room in the 4th grade in the foreign section where mouth conditions are fearful and practically untouched by private dentistry. They are very proud of their pennant.

As for the rural community, the Red Cross has employed a county nurse and she is given the opportunity to fill the clinic with patients from the rural districts one-half day a week.

Ninth District.—The ninth district was the only one not heard from.

Tenth District.—Dr. Beggs, of Cadillac writes that nothing is being done except what instruction the teachers give, which is very little and dental attention is sadly needed.

Unorganized, Houghton. — Nothing done there at all.

Sault Ste Marie.—Dr. S. T. Springer writes that in S. S. M. there is a dental room provided in the high school, but (like the story of the empty box) there's nothing in it. No equipment has been purchased or provided for. And the chairman of the school board is a dentist! I am glad they have at least gotten as far as the room. They at least won't be in the plight of the hungry man who said, "If we had some ham, we'd have some ham and eggs, if we had some eggs."

The health officer and city nurse examine the school children, but that's all and the aforementioned chairman has given one or two talks. The committee is of the opinion that he is throwing away priceless opportunities for wonderful service. They've made a start however and that is a great deal. "Get the spindle and the distoff ready, God will send the flax."

A few teachers in the country, to whom Dr. Springer has loaned articles printed in the National, have apparently done some educational work and the superintendent of schools has touched on the subject of oral hygiene in his annual report. He is heartily in accord with the suggestion of engaging dental hygienists for the city, but is handicapped.

First District.—(Being a polite committee, we mention our own district last.) *Highland Park.*—Very few people realize that here in our midst we have an independent thriving municipality, with its own health and fire departments, etc. That is we don't realize it until our house catches fire in Detroit a block from Highland Park. Their fire department can't come and extinguish the flames. No, the flames extinguish our house while we wait for a far-away Detroit fire engine to come to our rescue.

Highland Park has a live-wire oral hygiene program all of its own. Dr. Alvord, who has charge of it, reports the following:

"The Highland Park Dental Clinic was equipped and put in operation early in January, 1919, with one operator furnished by the city commission and a dental inspector, a woman of experience as office assistant, furnished by the Highland Park Schools.

"The clinic was inaugurated as an aid to those children financially unable to employ a dentist. Dental inspection and education of the children in the benefits and means of mouth care are the chief efforts put forth. All children examined are asked to take the card given them to the family dentist who is asked to sign the card showing that the patient is under treatment or has had completed the work required. These cards are returnable by a certain date and if not returned by that time, investigation is made. For those who cannot afford to pay, the clinic stands ready to give the required aid.

"A record of examination is made with date and upon re-examination, the date and general improvement or lack of it is noted. If needed, dental treatment is again recommended. A follow-up system keeps tab on the co-operation of the patient. Also accurate clinic records are kept. Toothbrush drills and lectures are given much more often than examinations. Children receive marks on their report cards showing their standing in 'mouth cleanliness.' At present the clinic is open four half days per week.

"Inspection in all grades up to the 7th is made by one inspector, 7th grade and up by another.

"Employment of two dental hygienists and four more inspectors is contemplated. About 6,000 children of school

age receive the benefit of this educational propaganda."

First District, Detroit.—History is always inspiring, so we'll have a little history of the Detroit movement. Twelve years ago, one night in dental meeting, Dr. Wm. Giffen suggested in a paper that something ought to be done for the school children. Drs. Grace Spalding, Burke, Bunting, C. T. Wood and Bowles were some of the dentists who helped work out a plan. Dr. Giffen and Dr. Bunting examined 600 school children in order to tabulate results and get some statistics. Thru Dr. Giffen, Dr. Babcock, of Grace hospital, became much interested and gave a room at the hospital and donated a goodly amount of equipment. A number of dentists in the then Detroit Dental Society signed up time for voluntary services, while others gave money instead. And there started the first clinic. It started out well—Dr. J. J. Jennings and J. B. Kennedy, then on the board of health, and Dr. Guy Kiefer, the health officer, helped get it started,—but the project fizzled out. Then Dr. Oakman became interested and it was thru him that an appropriation for $5000 went thru. Later it was raised to $8,000 and then, when Dr. Oakman was on the board of health it jumped to $20,000. That was so wonderful that it was written about in the press thruout the country. Detroit was one of the pioneers, following only New York and Cleveland. We have had for the past four years an appropriation of $25,000 which compared to Flint's $15,000 for 15,000 children and Bridgeport's $42,000 for 23,000 children, seems little indeed, when one considers that Detroit has 177,000 school children, including parochial and Lutheran schools. The number is growing all the time.

Thru the oral hygiene committee of which Dr. C. T. Wood was chairman, a moving picture film showing one of the correct methods of tooth brushing was made. This is the property of the state and is used for educational work.

In the present dental division of the board of health, there are eighteen clinics in operation, one, the main one, at the board of health, eight at schools, three at hospitals, one at the Detention Home, one at Franklin Street Settlement, one at the Children's Aid Society, one at the House of Good Shepherd and two circulating clinics, doing nothing but prophylaxis. These last have been combined since, but it is not yet quite the most satisfactory arrangement. There are seventeen operators and inspectors, including Dr. Thompson and the two dentists who are employed as hygienists, until they are accepted by the state board. All the clinics are not full time clinics, those outside of the schools and hospitals having usually one day a week. The House of Good Shepherd has an operator all summer, besides the several half days a week during the year. An operator is sent once a week to the tuberculosis sanitarium for all necessary extractions. He also goes when called to the receiving hospital. Boys applying for working papers have to pass a mouth inspection and unsatisfactory mouths are taken care of at the main clinic so that working papers may be obtained. Most of the work is for children—1% is for adults.

Every room examined receives instruction and education. Last year 73,000 children were examined. There is not enough education. In one school where I inspected the prophylactic work, I lectured to five rooms (extemporaneously, I may add) which had been treated. About two children in all those five rooms knew that the six year molar was the first tooth of the permanent set to come thru and was, therefore, an important tooth. Most of them thought it a baby tooth if they thought about it at all. If we don't teach the present pupils the great importance of that tooth, preschool age children will never learn it

and will keep on entering the primary grades with these important teeth hopelessly affected. But education takes time and with the present inadequate supply of operators, no one has the time. Dr. Thompson does wonders, but he is too busy to do all that needs to be done. Also instruction of various grades should be standardized, as other studies are. A child in the primary grades cannot grasp the dental instruction that a child in the 6th grade can.

At the main clinic the equipment is complete, including a nitrous oxid outfit and X-ray apparatus. All kinds of work is done there, even to the treatment of pyorrhea and filling of roots. When roots need filling, they are filled—properly. Forty cases of orthodontia were completed last year. The policy is to take only the most extreme cases, getting them as early as possible.

At the outlying clinics, of course, equipment is not so complete, only as much as is necessary for treatments, fillings and extractions being included.

Everyone is working hard, but the needs of these children of our great city are but pitifully supplied with our present appropriation.

The committee has presented but a part of the vast amount of data collected for this report. In fact, we have had so much information crammed into us that we just bristle with it. We feel people can see oral hygiene sticking out all over us. But let me tell you we also feel something else. A darky who was expounding scripture to a friend was telling him about miracles. "Yuh know what a miracle is? Shuah! Don' yuh remember how the disciples took five loaves and two fishes and done turned 'em into 5000 loaves and 2000 fishes? An' dey had to eat dem all deyselves. The miracle is—dey didn't bus'." The miracle is, we didn't "bust," both with information and enthusiasm.

Now what conclusions are we to draw from all this? In the first place, in this state we need widespread co-operation before any state-wide plan will be feasible. Each person's experiences will help all the others.

Then we need a law requiring dental inspection of every school child and with everyone pushing, we will get it.

We need a state lecturer—a dentist who is an enthusiast over this work and can imbue others with the same vital spark.

We need publicity in posters, magazines, pamphlets and in the public press. Publicity is a great thing. They say you can read yourself sick. As was once brought out, Why don't we eat duck's eggs? Because a duck lays an egg and doesn't say anything about it. But we do eat hen's eggs. Why? Because everytime a hen lays an egg, it's cackle, cackle, cackle, until everybody knows it. Publicity does it.

We need the work itself. If some ravaging disease were to attack our cows and pigs, the government would send a man post haste to investigate. But our children! If we raised pigs instead of children, our offspring might get some attention. We need the work not only in school clinics, but in special institutions for the treatment of children's mouths, hospital clinics and industrial clinics.

What is our great problem? To so treat our population that they will be immune from caries and later periodontoclasia. How can we effect this? By reparative work? We have been doing that. We've put in beautiful bridgework and some of it doesn't seem to stand up well. We try to remedy it and finally send the patient to the physician, with the advice to get his systemic symptoms cleared up or we will be unable to do anything in his mouth. The physician treats the patient in vain and then sends him to a dentist to get his mouth into better shape if he expects to recover. An eternal game of battle-dore and shuttle-cock which goes on till the bridge wears out or the patient.

Let us assume it to be possible to fill

this year all the teeth of the school children, so not a cavity be left. How are we to prevent recurrence of decay as well as to check the flood of cavities in the children coming into the primary grades each year? The toothbrush alone will not stop it and we all know how difficult it is to make a child brush his teeth. Would it not be better to inaugurate a system whereby a child's mouth could be made clean and himself and parents so enlightened and educated and followed up that he would keep it so? Wouldn't such a system influence his parents and the children of pre-school age in his home? With the additional knowledge of food values and how to properly masticate food instead of bolting it, dental caries would gradually become almost negligible in quality. The child would be a healthier, cleaner being, and quickened, mentally and spiritually. An uplift and different point of view comes with a clean mouth and polished teeth.

The two dental dispensaries at Boston and Rochester lay the greatest stress on preventive work and no one with any vision, or desire for the betterment of the race can deny that such a program is necessary in our state.

Now then, who is going to do this work? Not the graduate dentist. First, because there aren't enough of him to go around as it is and with the added expense of a longer time now taken to gain a dental degree and the fact that the production of dentists will not therefore be able to keep up with the education of the people, there never will be enough. He expects a good salary, naturally, and considering the large number of dentists required to carry out our plan, the expense to the state would be prohibitive.

Men don't like that kind of work, are not idealistic nor patient enough. Women are ideal for it. Their motherly hearts win the children, their patience accomplishes wonders in teaching, they have the necessary persistance to follow up the work closely and to attend to details that most men lack. As for going into homes and teaching parents, they can gain access where men often fail utterly. Mere quantity is the measure of success for the man who shovels coal or digs in a ditch, and let me add, for the average man who "cleans teeth." Women are far more conscientious. These statements are merely the testimony of a great number of men who know. Therefore, it appears we need women.

Let us summarize: A dental health program such as outlined is necessary. For this we need a very large number of workers. These should be women. We can't afford women dentists, but we need finely trained workers. What is the solution? The dental hygienist.

To those who object to the dental hygienist because it jolts their sensibilities for fear the advent of these women will detract from the dignity of the profession, let me, in closing, quote Mr. Hopson, of Great Britain:

"Just as during the war it was necessary to submit to the curtailment of private and individual liberties in order to achieve a greater freedom, so now the profession is called upon in the national interests to lay aside for the time being some of its cherished professional ideas, but I am confident that we will pick them up again and hand them down to our children, enriched, enobled and made secure."

TEACHING DENTAL ANATOMY

By R. D. THORNTON, D.D.S., Toronto, Ontario

(Read before American Institute of Dental Teachers, Detroit, Michigan, 1920)

BEFORE starting to teach the lesson that we have selected today, it seems necessary that we should have a mutual understanding of the objects which we are seeking to attain in teaching dental anatomy and of the subject matter that has been taught the class previous to this lesson. If we were to teach merely so that our students would be able to reproduce certain tooth forms, which have been presented to them as models, our method would be entirely different from that which we shall present today.

During the fourth century, B. C., Aristotle championed the broadly cultural in education as opposed to the claims of narrow utility and specialization. He stated that, "It is clear that only such knowledge as does not make the learner mechanical should enter into education." Modern college training for vocations, in which practical work occupies a large part of a person's time, seems to show a tendency to drift too much toward the utilitarian to the neglect of things cultural. The real objects of any college course should aim at enriching the experiences of the student so that he may:

1. Develop mentally, physically, spiritually and socially.

2. Render more valuable service to his fellow-citizens in return for which he may demand adequate compensation to provide for himself and those who are closely associated with him in his domestic relations.

3. Promote an advanced type of civilization.

In order to make the teaching of dental anatomy comply with the objects to be attained in a college course, it must be presented so that it will have some cultural value, so that it will provide some mental training and, at the same time, enable the student to apply his knowledge and skill to some practical use.

The attention of the dental profession today is focussed upon the prevention of disease as being the most important phase of our work. We still have, however, and may expect to have for a long time in the future, the necessity for restoring lost and broken-down tissues. Our restorations must be made with a view to the prevention of further trouble. The practice of preventive dentistry demands an intimate acquaintance with the normal or physiological before the abnormal or pathological can be recognized, hence the importance of dental anatomy in our course.

In the Royal College of Dental Surgeons, Comparative Dental Anatomy is taught as the foundation upon which the teaching of Human Dental Anatomy is

based. We shall take, for our lesson today, the upper first bicuspid tooth. The class has already been taught the functions of the teeth and their location. Special attention has been given to their development from the simple cone-shaped teeth of the fishes to the highly specialized teeth of some of the mammals with particular stress upon the relation existing between the teeth of the higher apes, pre-historic man, ancient and modern savages, and modern civilized man. The class has also been taught the tissues of the teeth with relation to the time of their appearance in the teeth of different animals, their arrangement in the teeth for different purposes and their gradual development from lowly organized tissues to highly complex organs. They have also been familiarized with the theories regarding the specialization of certain teeth for certain functions; the evolution of cusp formation; the different stages in the evolution of occlusion and the development of the temporomandibular articulation in its relation to the food habits of the animal.

When we start to teach the minute external anatomy of the human teeth, we begin with the upper central incisors and teach in a general way the anatomy of all the incisors, then all the cuspids, then the bicuspids and lastly the molars.

Special stress is placed upon the calcification of the incisal edge of the incisors and of the cingulum with reference to the effect that the formation of the different lobes has upon the shape of the crown. A mental note is made of the relative sizes of these centres of calcification and the approximate periods at which they start to calcify. When we reach the cuspid teeth, this knowledge is brought into use in teaching the formation of the cusp, the labial ridge, the lingual ridge and the incline planes of the crown. The size of the cingulum of the cuspid is compared with that of the incisor teeth and attention is drawn to any forces that may influence the size and shape of the different parts of these twelve anterior teeth. We aim constantly at keeping in mind two things which seem especially necessary.

1. Such a review of the known as will prepare the mind for the apperception of what is to be learned.

2. A skillful re-arrangement of the new matter whenever this is possible in order that the learner may detect the relation between the old and the new.

Experience shows that the student is more likely, at first, to regard each new thing to be learned as a distinct entity than he is to call up a related concept and to associate with it the new subject of thought.

There is a principle in pedagogics that "the abstract can never precede the concrete." Our perception of things must be acquired thru one or more of our five special senses and the most important of these is, feeling. I believe it is good practice in teaching to use as many of these senses as possible. In the study of dental anatomy, we may make use of three of them, viz: hearing, seeing and feeling. When the student has correlated these new preceptions so that he can form a mental concept of the object under consideration and can reproduce it in concrete form, then and only then do we consider that he knows his subject.

We resort to three different methods of impressing upon the student's mind the anatomy of the tooth. First, by the use of diagrams. Second, moulding of plasticine models; this is applied only to the first tooth in each type. After this, each tooth in the permanent dentition is carved from vegetable ivory. Owing to the inability of students to

carve very accurately, we do not finish our teeth in vegetable ivory until we have first carved the entire set approximately. Then we return to the anterior teeth and finish each tooth. During the period spent in carving them approximately, there are three things we aim to teach. First of all, we strive to teach the student to observe for himself; secondly, we try to give him a little knowledge of the anatomy of the tooth, and thirdly, we attempt to develop some skill in manipulation of instruments.

The second of these aims is very important. A little knowledge of the anatomy of the the tooth is all we attempt to supply at this time. Our first impressions of objects are of a general nature only. A more careful examination must be made before the several parts can be perceived. It would be utter folly to begin to study the anatomy of a tooth by starting at any given point and observing each concavity and convexity as they are approached. The whole would be lost from view in the study of its parts. In other words, we must get our general impressions first, and details later.

Each method can, perhaps, be explained best from this point on by the use of charts and the blackboard.

The art of questioning is, we believe, a very important feature in teaching. One of the chief objects in teaching is to hold the attention of the entire class. In order to do this, questions must be asked that can be answered in a few words, if possible. Long answers permit the rest of the class to wander mentally. In our work, we use, chiefly, the promiscuous and consecutive methods of questioning. Occasionally, we resort to the simultaneous method but its field of usefulness is quite limited, being confined usually to review work. With a few exceptions, the question is asked first and the student named afterwards; this attracts the attention of the entire class to the question that is being asked. The consecutive method may only be used at intervals and should not be followed for very long at any time. Sometimes, we apply the consecutive method according to the alphabetical arrangement of our class list and, sometimes, according to the arrangement of the students in their rows in the laboratory. We make it a point to return, occasionally, to the student who has been asked a question just a short time previously. This prevents any member of the class from assuming that, because he has answered a question, he is not likely to be asked another one for a considerable time and he may, therefore, feel justified in taking less interest in the quiz. The student, whose expression conveys the idea to the quiz master that he is quite sure of the answer, is not questioned nearly so frequently as the fellow who shows a tendency to be careless and to lack interest. Any answer that shows, in the slightest degree, that the student is making an honest effort, is accepted and he is encouraged by another suitable question which is intended to lead him nearer to the answer required. Sometimes, if the interest begins to wane, a question may be asked which includes the entire class and a show of hands is taken so that everybody must take an interest for a short time.

Care must be exercised in questioning so that due proportion may be established between the main topic of study and the less significant matter that is introduced in teaching it. For example, we are starting today to study the anatomy of the upper first bicuspid. That is the essential thing that must be foremost in the student's mind, but if we are not careful, he may misconstrue our lesson

into a study of calcification of the cusps while that is, in reality, only a part of the whole study.

We place but very little faith in the method of attempting to memorize. Principles and truths cannot be implanted in the student's mind by imposing upon him the memorization of empty forms of words which, to him, have never had any content. We must aim first at giving him some idea of the object itself and when he has grasped that idea, he will then be in a position to form his own definition, and the name may then be attached to it for purposes of convenience in description in the future. May I illustrate this by an example which occurred in our class last year? The student was asked, "What is a sulcus?" She replied: "A sulcus is a notable long-shaped depression on the surface of the tooth, the inclines of which meet at a definite angle." A molar tooth was handed to her and she was asked to point out a sulcus on the occlusal surface of that tooth. She had, however, no conception of what was meant by the definition she had memorized from Black's Anatomy and had just quoted to me. This shows us quite clearly that the words of the definition were mere empty shells to her, which gave her no knowledge whatever of the subject under discussion. True, she might have gained considerable information from such a method, but there is a marked difference between information and real knowledge. This illustrates another principle in pedagogics, namely, that, "words can never create ideas, neither can they convey an idea from one person to another unless the person spoken to has already formed a mental concept of the thing spoken about." We can never grasp new ideas independently of the things which we already know. Everything new that we add to our stock of knowledge must be acquired by association with the things we already know.

May we sum up briefly a few of the principles which we must constantly keep in mind in our efforts to impart knowledge to our students:

1. The abstract can never precede the concrete, or, in other words, realities must come first, symbols after.

2. We must proceed from the known to the unknown.

3. Words can never create ideas.

4. Generalities are grasped first and a more minute examination must be made afterwards in order to become familiar with the details.

PRINCIPLES OF EDUCATION AS BROUGHT OUT BY THE TEACHING DEMONSTRATIONS

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(Read before American Institute of Dental Teachers, Detroit, Michigan, 1920)

IF YOU will look at the top of page seven of the program, you will see a short and ugly word, "Critics." There is a shorter and an uglier word in the English language which has about the same meaning. When your committee saw that the term "critics" was to be applied to them they did not feel that a pleasant beginning had been made. However, they were thankful for one thing; namely, that the word expert, and especially the term "efficiency expert," was not used. The definition of efficiency expert commonly accepted by those not in that class is this: An efficiency expert is one who undertakes to tell others how to do something he cannot do himself.

It would be a little too near the truth to apply that term to us tonight. Look at the personnel of the committee: Mr. Edmonson, "Inspector of High Schools." What does he know about the subject of dental teaching? Mr. Packer, "Assistant Superintendent of Schools," is concerned with the erection of buildings, the administration of schools, etc.; what does he know about this subject? As for myself, I have charge of the research work in "reading, 'riting and 'rithmetic" in the elementary grades, and what can I be expected to know about college work? As a matter of fact, the sole point of contact anyone of us has with dentistry is the peculiar feeling which comes when the dentist suddenly guides his buzzing drill into the sensitive part of a cavity. We could qualify as experts under the definition, but as critics,—never! I do not think you could have dragged us here as critics without the aid of horses and yet—we are here. The explanation is very simple. We are here tonight as a tribute to the sincerity of purpose and open-mindedness of this group of teachers. It is very unusual for a group of professional men to invite outsiders to come in and advise with them about their professional work. We haven't found very much of this spirit in the programs of other groups. It appeals to the best that is in us. It makes us realize that in the last analysis this group is working for the same great aims we are working for. Accordingly, the first thing the committee wishes to do is to express our appreciation of your invitation. We count it an honor to serve you, and we are sure that anything we may try to say to you, as to our views of your demonstrations, will not be received as coming from critics, but as from friends actuated by motives of sympathy and co-operation. We feel we are all working together for improvement of education in America, trying to make that education serve the great purposes it ought to serve in a democracy. We are glad to accept our assignment on such a basis.

I met your chairman at dinner and sized him up as an honorable, likable man, but when I came to this meeting and listened to the papers I wondered if I had not been mistaken. For after picking out teachers of marked personality and exceptional ability to present

your methods of teaching by means of the demonstration you have just witnessed, he then asked us to make a few suggestions. Do you think it is fair to ask a man to attempt to make criticisms and suggestions under such circumstances? The situation has been loaded against us. I do not see that we have a ghost of a show. We have absolutely no criticisms to make. What can we say in regard to the demonstration? In order to make any report at all, we shall have to go behind what was actually done and base our discussion on fundamental educational principles.

Some one has defined education as the process of changing students from where they are to where we think they ought to be. I wish to emphasize several important elements in the definition. First of all, notice the use of the word "process." It means that an account of the teaching that goes on in one room is not the whole story. "Process" calls attention to the fact that there are several agents acting, and that what you do as a teacher depends primarily upon what was done by the teacher before you. In similar fashion, what you do will determine what it is possible for the teacher who comes after you to do.

The next important element is the word "change." We need to keep constantly before our eyes the changes that are produced in the students by the work we do. It is our duty to change them from somewhere to somewhere, and to act intelligently we need to know what they are at the start and what we want them to be when we get thru.

If we accept this definition, there are three great questions any group of teachers must ask:

First, what changes are desirable?

Second, what is the best way to teach to produce the desirable changes?

Third, after we have tried our best to bring about the desirable changes, what is the actual effect of our efforts?

Let us discuss these questions a moment. Take the first question, "What changes are desirable?" I wish to ask upon what basis Dr. Thornton justifies the selection of the items he included in his lesson? He presented a great many technical points. I kept up as best I could but was out of the race at the end of the third lap. I never heard of a sulcus before, nor of a groove or pits or fissures and the rest of the things he mentioned after that. Most of the time I could not tell whether he was merely calling the committee names or was really leading us into new ground. After I got lost, I sat back and began to wonder—I could not follow what was going on—I began to wonder how many items of that lesson are really essential to the success of a dentist? I began to think about some of the things that have happened in our own field. When I went to school I had a spelling book with 30,000 words in it. In recent years school men began to wonder where the makers of spellers got those 30,000 words. Shakespeare used only 15,000 different words, Milton only about 8,000. When men came to consider the spelling problem seriously, they began to say, Why should children study so many long and difficult words when they are not able to spell the common words which everyone uses? And finally a man was bright enough to make a careful investigation of the actual number of different words people use in letters and published articles. He found that about 1,000 words make up ninety per cent of written English. So in our schools today we have a very short course of study made up of just the 1,000 important words which are taught, and written and reviewed over and over until they are completely mastered. When our pupils can spell the few important words, they are far along the road to being educated as far as spelling is concerned, and then we can safely let them acquire by actual use whatever knowledge of the rest of the 450,000

words in the English language it is important for them to have.

Not long ago I was present at a meeting where a committee was reporting upon the minimum essentials in history. The chairman of that committee had been at work for something over a year trying to select the dates in American history which every cultured and efficient person ought to know. He had obtained lists from noted historians and had compared them and submitted them to business people and others, until finally he had a list of dates he considered absolutely essential for an educated American to know. The original list of 150 or more had been reduced to 20. Here, then, was an irreducible limit of 20 dates. The chairman applied this test to those present at the meeting. The first date was 1492. That was easy. So was 1776. But the next one I did not know, so I blinked my eye once or twice and smiled pleasantly. However, the next one I did not know, either, So there I was, clearly classified as uncultured and inefficient. I began to look at the floor and felt my cheeks burning. Then came three or four more dates I did not know, and finally I became bold enough to look up and see what the other men were doing. Well, some of them were looking at the floor and some were brazenly looking around the room just as I was. Before the chairman had finished his twenty dates, the entire group burst into laughter. Only the historian himself could go thru that list of dates and give the right answers to all of them.

Wherever we have checked the subject matter we were teaching in the schools, we have found that we were using a great deal of material that was unessential. And so now before we teach any lesson we feel it is incumbent upon us to check ourselves on the value of the subject matter selected. Therefore, I wonder how far Dr. Thornton can justify the particular items that he chose. Surely, if some of you dentists went over those teeth with the microscope you could find a few thousand more little dents and creases in the teeth which he did not mention; probably in Black's *Anatomy,* there are several more figures and diagrams to which he did not refer. How did he decide that the particular items he picked out were the ones worth while teaching? If those things really make for the efficiency and general culture of a dentist, there ought to be some proof of it. If we are going to teach those items of knowledge and take time to do it well, it seems to me we ought to make the effort to find out exactly what the relative importance of the different items really is. Suppose I asked Dr. Thornton to make out an examination based on his lesson giving the kind of questions he would expect to ask his class, and then gave it to the men in this room. I wonder what score you would make? I wonder how far, if I took Black's *Anatomy* and asked you to make a lesson from the material there, your selection would be the same as that of Dr. Thornton? One of the important things we are trying to do in our field of education is to make sure that our selection of lesson material is not based upon individual opinion, but upon actual worth. I believe the same principle applies to your particular line of work as well. In every lesson and in every subject you should determine by direct experiment and measurement the value of the work you require of the students.

We will pass that. Let us take the position that Dr. Thornton is right, that he has selected the things which are of most value, that he has a basis behind his selection, an objective basis, and knows that his lesson deals with points of value. We come then to the second question—the method by which we shall teach these points of essential value to the student. I was very much interested in Dr. Thornton's statement as to the real objects at which any college course

should aim. He began just as we do on our side of the educational building: He said he was working, first, to develop the student mentally, physically, spiritually and socially; second, to enable him to render service to the community, and, third, to enable him to contribute to the progress of the race. That is fine, it is just what we are working for. Then he went along, just as we do—and didn't mention these points again. His questions were concerned wholly with items of knowledge as far as I could see. Why he chose this method or that question in order to get the effect of development, or in order to bring out the ideal of service, I had hoped he would explain. But he did not do so; he just passed these questions by. I am sure it was considered; for he had such aims very carefully listed and I hoped to see just how he was going to achieve them. In our work we, also, state our aims on one side of a page, then on the other side, we concern ourselves mainly with questions of knowledge and skill. So, if I were to follow the discussion thru, I should say that the basis of organization of Dr. Thornton's lesson was the logical arrangement of subject matter and the minute analysis of that subject matter to get in every phase of the teeth and their relation to each other—size, length, position, and all other factors. It was a minute analysis of subject matter organized on a basis of knowledge, and it was presented in such a way that the emphasis was on knowledge.

Last year I was fortunate in being able to secure a leave of absence for a year of study. When you have 114,000 children on your hands and realize that you can make or break the characters of these children by the course of study you prepare for them, the time comes when you do not dare to carry that load until you find out what the very best philosophical and psychological thought on such questions is. I went to Columbia and found that they were basing their educational theories on philosophy, not the old-fashioned kind, but the modern philosophy that grows out of a scientific psychology and sociology. The four fundamental things which they said were the most essential for upbuilding and upholding of democracy were:

(1) Self-direction—the ability of an individual to carry forward his own work under the drive of his own desires. In an autocracy, the common people have things passed down from above and they accept and approve them without question; but in a democracy we like to think of activity as being carried on with the consent of the individual and by him and for him. That means that the individual must be capable of carrying on his work under his own direction.

(2) Self-appraisal—the ability of an individual to tell whether or not his work is good. All progress comes from a realization of shortcomings and a desire for better things. Progress in a democracy comes from self-appraisal.

(3) Self-control. Little children do not have self-control. It must be acquired. No worthy purpose in life can be achieved without it.

(4) The ability to engage in work co-operatively with one's fellows.

Those are the four fundamental products we must secure from the educational process, and everything else in teaching is but a means to these ends.

Believing in self-direction, as I do, you can imagine my astonishment when I heard this group of teachers laugh aloud at the statement of a student in the illustration given by Mr. Edmonson. You remember he thought the work of the professor he described was defective and suggested that most of what he learned *he taught himself*. You all laughed at that. But that is the very best way to learn. I do it. You do it. Why isn't the method of teaching oneself a good thing to put in the student's possession?

I saw an adult Americanization class the other day. The teacher was giving

a group of foreigners "Jack and Jill went up the hill." Wasn't that absurd? One of the men was a young Spaniard who could talk English but couldn't write well enough to join his trade union and get a job. How much of value do you suppose he could learn from "Jack and Jill?" But another teacher explained to him the value of the list of the thousand commonest words in the English language. He took that list home and learned 800 of them in three days. Was that bad? If you gave him an examination on those words and tested him to see whether or not he had mastered them you would find very fine results from his study. Yet you laughed at the method which made this possible. I think we all should work for the ability of an individual to carry on the learning process by himself. In my field, we are trying our very best to devise methods of procedure which will set students free to carry on their work under their own initiative.

Then you passed over and accepted without question the following statement in Dr. Thornton's paper:

"The art of questioning is, we believe, a very important feature in teaching. One of the chief objects in teaching is to hold the attention of the entire class. In order to do this, questions must be asked that can be answered in a few words, if possible. Long answers permit the rest of the class to wander mentally. In our work, we use, chiefly, the promiscuous and consecutive methods of questioning. Occasionally we resort to the simultaneous method, but its field of usefulness is quite limited, being confined usually to review work. With a few exceptions, the question is asked first and the student named afterwards; this attracts the attention of the entire class to the question that is being asked. The consecutive method may only be used at intervals and should not be followed for very long at any time. Sometimes we apply consecutive method according to alphabetical arrangement of our class list, and sometimes according to the arrangement of the students in their rows in the laboratory. We make it a point to return, occasionally to the student who has been asked a question just a short time previously. This prevents any member of the class from assuming that, because he has answered a question, he is not likely to be asked another one for a considerable time and he may, therefore, feel justified in taking less interest in the quiz. The student whose expression conveys the idea to the quiz-master that he is quite sure of the answer is not questioned nearly so frequently as the fellow who shows a tendency to be careless and to lack interest."

What does that mean? For whose benefit is that quiz conducted? Do the suggestions indicate student direction or teacher direction—do they mean student control or teacher control? Did you ever watch a teacher questioning his class on such a plan? The teacher first asks the question and perhaps three or four of the bolder students raise their hands. If the answer given is wrong, all the hands go up because usually there are only two alternatives: if one answer isn't right the other is. The children are merely trying to give the answer the teacher wants. That is teacher direction.

I wonder how many of you men have ever been to a dental clinic where a famous dentist was operating, and where you had a chance to be a member of a select few who could discuss the technic of the operation with the dentist at the close of the clinic? Did he have to ask you questions, or was the questioning on the service basis? Did you not ask about the points that puzzled you and did he not answer your questions? Then did not somebody else ask a question about his difficulty, and have it answered? So the dentist went back and forth, in that way contributing to each one of you. Did not the initiative for the questioning come from you and not from him? Is it

possible to have such a method used in a class? We know it is.

The value of the method lies in the fact that it produces a different emotional situation. Let me prove this to you. I have been teaching by what we call the project method. For instance, I have been putting ideas before you and allowing you to select those ideas which are of particular value to you. Each of you has been working my material over in your mind in the way that seems to you best. Now let us change from that democratic method to the autocratic, teacher-domination method. I have been speaking from an outline. Any competent listener, paying attention to what has been said, ought to be able to get up here and reproduce the main points that have been given. I wonder whom I shall call upon? (looking over the audience.) It is a funny thing, but when I threaten to ask a specific question like that, I see some of you doing just what Dr. Thornton said some of his students do. If I call on this gentleman who is looking the other way, I am likely to catch somebody who is quite sure he cannot answer my question. There are very many of you who averted your eyes from mine. And didn't you notice, in yourself, the change in your emotional adjustment? Where you are free to get the thing that is of value to you, isn't your emotional state very different from that which you have when I call on you and ask you to give answers according to a set program of my own of which you could not possibly know the plan?

The thing I want to make clear is this: In recent days psychologists have been studying the action of the human mind, and by experiments they have determined the laws by which learning takes place. They say that the laws of learning are just as definite as the laws of gravitation, that they are just as positive in their operation as any other kind of natural laws. If you expect to teach effectively, you must organize your work to take advantage of those laws. The only way to do that is to present a situation to an individual and let him respond to it in his own way; because if any one fact has been clearly demonstrated it is that individuals differ. No two individuals are alike; none of us has exactly the same opinion on any subject as another. When Dr. Thornton presents his facts about teeth to a group of students, every single student responds to the presentation in a different way; each one needs explanation, or assistance, starting at his own point of difficulty and proceeding according to his own particular psychology. If we are to teach effectively, then, what we have to do is to organize the situation, present it to the students, and then let them show us the points at which the explanation shall occur.

From this point of view, if I were to organize the work Dr. Thornton presented, I should first try to determine the sequence in which the ideas would occur to the students. I should pay no attention to the logical order. I should present the subject to the students and study them. When I found the way in which most students respond, I would try to put before them the idea of learning what a sulcus was and I should provide them with written instructions. Dr. Thornton gave orally certain instructions, and I learned partially what a sulcus was. Couldn't I have done better if he had prepared written instructions? Perhaps if he had submitted his directions to a number of teachers until he had them arranged in the best order, they would have been better than his spontaneous oral instructions. That is, I could read the directions, take the tooth, work with it in my own way, find out what I had to do, then study and observe until I could say, "Yes, I know what a sulcus is. Test me, and see whether or not I can prove that I know."

The second thing I would do is to so present the subject to the class that they

could see why this knowledge was essential to the skill or the success of the dentist. It would be done in such a way that they could see the functional relation of this knowledge to their work. This would make them feel that the lesson was a real step forward toward becoming a dentist and they would then desire to undertake to learn the lesson if they had any desire to succeed as a dentist.

Then for the third step, I would turn the lesson over to them and pass over with it all responsibility—I would not take a bit of it. It is not the teacher's business to make the students work—they should make themselves work. I would say "I am the expert, I know what Black's *Anatomy* means. Take these instructions, study them. If you don't understand them, I am ready to give you such assistance as you may ask for. Here is a test to tell whether or not you have mastered the lesson. When you can pass the test yourself, come and I will give you another one like it." I would meet each student at the point of his peculiar difficulty and have the tasks so arranged that if a certain member of the class could get thru four exercises in a day and another student could do but one exercise in four days, each would be left free to work out his problem in his own way and in his own time. I would put my entire relations with them on the service basis. In other words, the teacher's business is to serve his students, to make his expert information available to them, to assist them in working out their own development. In that way you get self-direction.

Also, I would so organize the objective definition of the goals I set up that they would serve as a means of self-appraisal. For instance, I would have a scale of ivory teeth made from those carved by students. The scale would consist of specimens ranging from the best representation I could get down to the worst one I could find, and the relative value of each sample would be determined and given on the sample. And when a student brought a block and asked me if his work was satisfactory, I would say, "Is that satisfactory to you?—judge for yourself: Here is a sample made by the most skillful dentist I know, and here is one made by the worst. Here is a sample which represents the lowest possible degree of skill a dentist can have and be a successful dentist. Judge for yourself." After comparing his work with the scale, he would then say, "My work is very poor, I will do it again." If he condemns himself he is ready to try again and with an emotion which makes learning possible. On the other hand, if he passes in his work feeling that he has done well and you tell him it is poor, he will not appreciate your criticisms and will resent being asked to do the task again. Self-appraisement leads to self-direction and willing struggles towards high standards.

Finally, after the student has brought himself up to the standard which we say is essential for the attainment of a certain class of work, I would provide an exercise in which he could put to use these things he had learned. I would have a test whereby he might become aware that he is now a better dentist because he has that knowledge than he was before he learned it. I can demonstrate this to you in my own field, I cannot, of course, in yours. In one school with which I was connected we had a make-believe grocery store. The students played in this grocery store. The money employed in their transactions was only make-believe money—we gave them $100 for twenty-five cents—but it was just as real to them as real money could have been. The children gained or lost as the prices rose and fell. Some of the children wanted to serve as clerks. All right—a clerk is a person who must be able to make out a sales slip and add it correctly and rapidly. Here is an addition test. No one can be a clerk who cannot pass the test. The children would

take the test, and after they had practiced awhile, they came to me and said: "Now try me, I am sure I'm up to standard." I would try them and say: "Yes, you are up to standard. You can be a clerk. When you get up to the next level you can be a cashier." Every bit of practice was done under self-direction in order to achieve a definite goal. This plan of work would undoubtedly contribute to the making of good dentists.

Now, I have spoken of these things rather strongly and rather clearly because I wanted to emphasize the fact that we have, growing up in education, two opposing points of view. I cannot say to you, "This is the only point of view; this is right," altho I believe that it is right. But I can say to you with absolute certainly that in the school work over which I have control, wherever I have been able to try it, we have demonstrated from this method very much greater returns than from any other. In handwriting, for instance, we have 30,000 students being taught on this plan and I can take you into room after room in which the teacher has nothing whatever to do except to assist the children, when they say, perhaps, "My slant is not right. How do you make the letters all slant right?" As you go thru these rooms the detail of the work is under the control of the children and they will not let you interfere with it. The children have a different attitude of mind toward their work. It amounts to a different type of teaching, and the net increase of efficiency under this method is about fifty per cent. By efficiency, in this instance, we mean the average results obtained in a measured experiment under control conditions. It was found that under former methods we achieved about 34% of our goal: The efficiency of most school work wherever we have been able to measure it, is very low. The new method increased these results 17% the first semester it was tried. That is, the new method made a 50% increase in our output, and at the same time decreased the amount of work done by the teacher and increased the pleasure of all concerned.

Perhaps the best proof of what I have been saying is the reports given at these meetings you are holding and the effect they have upon you. Is it not true of you when you are in situations where you want to learn from each other—as out in the hall before this meeting when you were interchanging confidences as to certain ways of doing things—that you learn from each other on a service basis? Some of your number are already using these methods in their teaching, and perhaps that is the most convincing proof of all.

So you see there are two methods of teaching developing in this country. They represent a difference of opinion. How is that difference of opinion to be settled? Simply by guess and by gosh? Or are you going to be scientific about this and say, "It is up to us to measure the effect of the kind of teaching we are now using. Then we must both try and measure the other kind of teaching. Finally, we must put the results side by side and determine on the basis of the facts which is the better way.

This brings me to Dr. Whipple's paper—how you can apply scales to your teaching—so I will leave further discussion of this point to him. But I want to leave with you for your consideration three questions:

(1) Is it not a part of your responsibility as teachers to measure the relative importance of the various items of subject matter you teach, so that your requirements may be based upon actual, and not assumed, values?

(2) Is not the development of power to direct and appraise one's own work of greater value than the development of mere knowledge and skill?

(3) As there are in existence in the world other methods of teaching than your own, is it not essential that you learn by actual experimentation and measurement which methods are most effective?

PRINCIPLES OF EDUCATION AS APPLIED TO DENTAL TEACHING

By RUSSELL W. BUNTING, D.D.Sc., Ann Arbor, Michigan

(The President's Address, read before the American Institute of Dental Teachers, Detroit, Michigan, 1920)

AS WE glance thru the history of the Institute of Dental Teachers we note that during the twenty-seven years of its existence this organization has passed thru several distinct phases. Organized by a small group of dental teachers who met in Chicago in 1893 to discuss methods of teaching operative technics, up to the present time, the Institute has wielded a mighty influence in shaping the policies of dental teaching, and from time to time has enlarged and adapted itself to meet the newer situations in dental education. At first its deliberations were confined solely to the teaching of operative technics and subjects which were closely allied to that branch of dentistry, but gradually its scope was broadened to include the teaching of prosthetic technics, orthodontia, and special phases of technical procedures. In the sixth year of its progress this organization had so far broadened its activities that it included the consideration of all subjects of the dental curriculum, and, in token of its more comprehensive purpose, its name was changed from that of the National School of Dental Technics to the Institute of Dental Pedagogics. The Institute as both the latter title and the present appellation, which was adopted in 1914, implies has been primarily concerned in the development of dental education, its object being set forth in the constitution as that of "the improvement of the educational department of the colleges comprising its membership."

During the years that have passed the dental colleges have been confronted with serious and difficult problems. Twice have they passed thru the ordeal of extending the dental curriculum from three to four years, the first attempt meeting with failure and the second succeeding; and now they are again confronted with the necessity of increasing the length of the dental course. Year by year papers and discussions have been presented before this body in which the attempt has been made to perfect a sequential order of subjects taught, to correlate them one with the other, and to establish a standardized uniform curriculum which might be adopted in all dental colleges. In the ever changing situation in which new courses were added and the years of instruction were increased, this Institute has been an open forum in which free expression of diverging opinion has been voiced to the end that by discussion agreement has been reached regarding the essential features of the dental curriculum.

This has ever been a non-administrative and non-politic body acting solely in a deliberative and advisory capacity to the executive heads of the colleges represented in its membership. During all the turbulent times thru which the Dental Faculties Associations have passed the Institute has continued in the

even tenor of its ways unaffected by the storms which have raged about it. Its meetings have been like the gathering of the clans where all petty jealousies and personal grievances have been set aside, where the humblest instructor is on a par with the haughiest dean, and true fraternal spirit prevails. To those who have been regular in attendance, the meetings of the Institute have been the most enjoyable and in many respects the most helpful of all dental gatherings. Here we have met shoulder to shoulder with the leaders of our profession, we have heard them express their ideals and aspirations as teachers and the methods by which they sought to give these ideals practical expression in the class-room, and we have gone home feeling that our vision had been broadened and our usefulness as teachers increased.

But as we stand today viewing the progress and achievements of the past and looking forward to the new problems of the present and the future, we hear the call for still newer phases of dental education to which this Institute should respond. Up to comparatively recent years we have prepared our students for the practice of dentistry by confining their attention almost solely to four square inches of the human economy, and have taught them to perform sundry operative and therapeutic procedures upon the tissues therein contained. In the light of recent developments we have come to see more clearly the relationship between the mouth and the body as a whole and the significance of dental operative procedures to the general health.

By virtue of this concept, dentistry has become a highly important branch of the healing art. No longer is she solely concerned in mechanical and technical procedures, but rather has she entered the field of speculation in which her primary interests are the conservation of the health of the patient, to which all operative and restorative procedures must be subservient. Her outlook has been widened so that it comprehends not only the conditions of the mouth, but also the body as a whole, the significance of dental disease to general health, and conversely the relationship of general and systemic diseases to the mouth. Thus has her field been broadened and her responsibilities increased.

Our students of today, when they enter the practice of dentistry will be associated much more closely with the medical profession than their predecessors have been. They will frequently be called in conference to assist in the diagnosis of general diseases of obscure origin, and a knowledge of more than purely dental character will be expected of them. To acquit themselves creditably in this situation they must have a broad foundation of the basic medical sciences, they must have a clear conception of those conditions which lie in the border land between medicine and dentistry, and most important of all they must be able to reason between cause and effect. Our students therefore must be trained to be thinkers as well as doers. They must be thoroly grounded in the underlying principles involved and at the same time encouraged to so develop their reasoning powers that they may learn to analyze each individual case, to reason from cause to effect, and determine what is the proper course to pursue.

President Wolsey has said that "the chief purpose of a college is to cultivate the power to think." Can we truthfully say that the chief purpose of dental colleges today is the training of men to think, or rather are we not forced to admit that our teaching consists largely in cramming certain prescribed courses of instruction into our students, or in directing them along certain definite and prescribed methods of technical procedure? As a rule, education in professional schools tends toward the cramming method or the imparting of knowledge to the student which he may

take or leave as he chooses. It is a basic principle of education that efficient teaching consists not only in the impartation or delivery of information to the student, but also involves on the part of the student an active reaction by which he assimilates this knowledge and makes it his own. In other words, before efficient teaching has been attained the student must be led to think in terms of the subject taught.

The methods by which this efficient teaching may be accomplished consist in the employment of certain plans, schemes or devices by means of which the student is stimulated to an active interest and thoughtful consideration of the subject. Of these methods the lecture system is undoubtedly most commonly employed. A relatively small number of teachers who are forceful magnetic speakers are able to hold the attention of their students and to stimulate an active mental reaction by the purely lecture method. Successful teachers of this type are extremely rare, while the great majority who rely upon this method fail to obtain the desired result. Frequently the student, altho he makes a conscious effort, is unable to follow the line of thought of the lecturer and occasionally the lecturer himself fails in this regard. Too often the student sits with his eyes fastened on the teacher in the attitude of rapt attention while his mind is far away reveling perhaps in the anticipation of a holiday trip to his old home and the fair young damsel who is awaiting him there. At the close of the lecture the only mental reaction that has been produced in the student has been that of a sub-conscious effort on his part to appear interested. Most of us less fortunate members of the teaching profession who do not possess the gifts of a silver tongued orator must resort to some other devices in order to hold the attention of the student to the subject under consideration and stimulate in him an active mental reaction to it. To this end have been devised many schemes such as written and oral quizzes, note-books, theses, final examinations, and many other methods by which the student is encouraged to think for himself. These various schemes have been thoroly tested and evaluated as to their efficiency by the educational department of schools and colleges of this country and have been recommended by them as valuable, and essential instruments for efficient teaching.

But I hear some one say, "these are high school methods and have no place in a professional college. When men come to us they know what they have come for and will get the instruction without these compulsory methods." In reply I will ask, if left to his own choice, how much and what part of the dental course would the average student conscientiosuly pursue? It is my opinion that he would spend the great majority of his four years in the clinic or infirmary and would give but scant attention to those underlying ancillary and basic subjects which are so necessary to his education. If, then, he is less interested in these fundamental subjects, it is especially necessary that in the presentation of these courses the teacher utilize every method and device that is at his command to stimulate the student's interest to the end that his mind may be developed to fully comprehend these subjects. Not that he should be driven like the slave to the quarry by the goad of a task master's lash, but rather that when his interest has been aroused he be led by his own desires to thoroly master the course and make it his own.

If then we admit that it is expedient and desirable that we as dental teachers should employ certain methods of instruction which have been adopted by educators in other fields, would it not be worth while seriously to consider this question in the meetings of this Institute? Altho this body has been known as an association of dental teachers, its

deliberations have been almost entirely confined to subject matter taught, and little or no consideration has been given to the teacher or the method by which he presents his subject. At our last meeting, President Thornton in his address emphasized the need of a consideration of the principles of education and teaching methods in dental colleges. The suggestions which he made seemed to the present executive board to be so timely and so worthy of consideration that it was decided to devote a major portion of this meeting to a discussion of teaching methods in the light of established principles of education. To assist us in this enterprise we have secured the services of a group of prominent educators who have given largely of their time and interest in working out the program which will be presented for your consideration. To these men I wish at this time to express my personal gratitude and appreciation of their efforts in our behalf. To this program I respectfully invite your attention with the hope that as the meeting progresses you may decide that the consideration of teaching methods is of sufficient importance to this body to warrant the establishment of a standing committee to continue this form of discussion in the succeeding years.

An important problem to be presented at this meeting is the disposition of the dental index. From year to year the Index Bureau has reported progress in the organization of this colossal work and have asked for assistance and co-operation from the Institute to put it upon a sound and permanent basis. These requests have not received the unanimous response on the part of the colleges or their faculties which the importance of the enterprise warrants. When we realize that the dental profession has relatively few text books and that the great part of our literature both past and present exists solely in current magazine publications it becomes evident that a complete and workable index to this literature is very necessary. At the present time many worthy contributions lie buried in some professional magazine, forgotten and practically unknown. How often have we seen treatises on various subjects in which the author has evidently overlooked a previous contribution on the subject which had it been known would have clarified his vision and amplified his views or perchance may have obviated the necessity of his paper. The Index Bureau will in their report make certain recommendations to this body outlining the plan by which the Dental Index may become a reality. I trust that these recommendations may receive your earnest consideration and that definite action may be taken before the close of the meeting that will bring the work of this Bureau to an early consummation.

In conclusion, I would bespeak for the executive board your charitable consideration of this meeting and the withholding of hasty criticisms of any defects the program may contain. Like all innovations certain features of our proceedings which are of the nature of an experiment may not work out as they have been planned. Every effort has been made to perfect the details of their presentation with the hope that suggestions may arise which will be of sufficient importance to justify further consideration. Dentistry is today entering upon a new era and is engaging upon a field of increased service and responsibilities which hitherto have been unknown. We as dental teachers stand as leaders and directors of the young men who tomorrow will take their places in the profession to meet these new problems and to work out the dentistry of the future. Ours is the double responsibility and privilege to provide that by all means these young men are well armed and equipped to take up the task that is before them. Let us therefore work together in this meeting in the spirit of friendly co-opera-

tion considering only those things which will send us back to our class-rooms as better teachers and leaders of men.

DISCUSSION

A. W. Thornton, Montreal, Canada: I want to congratulate President Bunting very heartily on the sanity of the paper to which you have just listened. We left home on Thursday night in order that we might spend the week-end in the little town in which I started to practice. Walking along the street, I met a man I knew quite well, something of a wag and character around town, and I said, "Well, Wesley, how are you?" He said, "I am very well, doctor, if I was any better I would have to take medicine." It reminded me of the President's paper—it is neither very much above nor is it below the standard, but is a healthy presentation of issues that are very vital at the present time.

Reference has been made to the methods of teaching and to "silver-tongued orators." As to the last, you have often heard the assertion that talk is cheap. I think the worst thing you could possibly have in your school would be one of these silver-tongued orators. They are usually carried away with their oratory, the beauty of their language and the harmony and rhythm of their sentences, rather than concerning themselves with the meat that they are giving to the students. Words are cheap, we often hear that, and in some cases it is true. But if words are worth listening to they are the dearest things in the world—dear in the sense that they are scarce and hard to produce, and no man ever says anything worth listening to unless he has paid the price of production. And that price means that he must be alone and that he must read and think, and as a result of being alone and of the labor which he bestows upon his chosen subject he produces something worth listening to.

Your President referred to the fact that we are now wrestling with a problem that has been recently mooted. He spoke of the fact that the length of the term had been changed from three to four years, and that now some are advocating a five-year term. I trust that for the present and for a long time in the future no such change will be made. I know that such a change has been made in medicine, first from a four to a five-year term and then from a five to a six-year term, and I happen to know also that some of the faculties who have adopted the six-year term are at a loss to know what they are going to do with the time at their disposal. They are bringing in all kinds of subjects, even giving courses in English and literature, but literature cannot be taught in that way. And, more than that, to take six years out of the productive period of a man's life is too great a price to ask a man to pay in order to render to the public the service which the ordinary public demands.

And so, rather than to give a five-year course, let us make an intensive four-year course to give a man an intelligent conception of his profession and enable him to go out to give efficient service to the public; then for those who wish to go further and qualify themselves for the higher branches, give post-graduate work, after they have had something of the training and experience that come from general practice, when they will go out and practice the specialty for which they have spent the time much more efficiently than if they were to spend that additional time during their preparatory work.

One of the most important points discussed by your President was when he referred to the fact that almost our entire time for the four years is spent in connection with four square inches of the human anatomy. He touched on a subject that I think must be attended to by the various colleges and universities

that are teaching dentistry at the present time. I have had the advantage of six years, and am now entering my seventh year, of exclusive hospital practice, and I am grateful for that advantage and for what I have seen and learned there. Reference has been made to the fact that dentistry today is a most important branch of the healing art, and the dentists of today must recognize this and be able to meet on common ground the men who are exclusively engaged in the healing art. Students of the past, those who are practicing today, are not able to do that. The British government has recognized that fact. When Britain entered the war thousands and thousands of her men were rejected for military service because of mouth conditions, and Britain awakened to the fact that the general welfare of the community had been neglected and that one of the great causes of inefficiency was the mouth conditions of her people. And now in this period of reconstruction she has become perhaps one of the most democratic of all the nations of the world and has established a department of the government to look after the physical well-being of the people. Just a short time ago the Premier of Great Britain said that he believed the most important part of the work of this new department of the government was in looking after the mouth conditions of the common people of England—a matter which had been so seriously neglected in past years. And so it is not imposible—it is quite possible—to send our students out capable of performing the ordinary operations of dentistry, and capable also of diagnosing and having an intelligent appreciation of the systemic conditions which are brought about thru mouth infection, and even tho they do not treat these conditions (and they should not, I think, enter on that phase of the work), they will at least be able to appreciate them and to discuss them intelligently with the family physician.

I wish to again refer to the forceful, magnetic teachers, and yet I wonder if they really do any good. We do not after all produce very many extraordinary men. Most of our students go out as we went out ourselves—ordinary men to do ordinary work for ordinary people.. But here and there have been extraordinary men. I think they owe very little to their schools, but many of them owe much here and there, to one man who has had an influence on their lives. You remember what was said of the great teacher of Britain—that he inspired the men who listened to him. And so there have been a few men who have been able to inspire those to whom they have given tuition. In reviewing this paper I was reminded of the life of Dr. G. V. Black and of his early advantages. He was great, not because of the schools, but because early in life he had received some inspiration that influenced him in his work. And so, in spite of the lack of early advantages, he became great.

At one of the first meetings I attended in connection with this Institute, I heard Dr. Brophy use one sentence which struck me at that time as being very strange, but I am convinced now that there was a good deal of truth in it. He said that it would be a good thing for the dental profession if there could be a fire in the homes of those who taught in colleges and burn up the notes which were used from year to year, to the end that every year new notes would have to be prepared. I do not know whether you agree with this view, but if you have been at the head of an institution for some years and have seen a man come in and pull out the lecture, folded, yellow with age and worn out at the creases, and then get up before his class and read it the same as he read it last year and the year before and the year before—in that case you would, I am sure, almost

be tempted to pray for a cataclysm of some kind, fire or flood or something else, to enter that man's home and destroy those notes. Often at the end of a session I wonder what I have accomplished, and usually I have been forced to the conclusion that I have not accomplished very much. But I do feel that I accomplished one thing within the last two or three years. We had a boy in our school with the most forbidding face I have ever seen; he never smiled, ugliness was written all over him—he was ugly with the students, he was ugly with the clerk in the office, he was ugly with everybody and everything. And one day I called him aside and said: "Say, you are going to make a good dentist, that is, you are going to be able to make good fillings, good dentures, crown and bridge-work; but you will never have a practice, your face is so ugly people will never come to you." "Do you think so, Doctor?" he asked. "I'm very sure of it," I replied, "I have never seen you smile since you entered college. You must learn to laugh, you must cultivate a sense of humor, and if you do that there is some chance that you will accomplish something in the world; if not, you are a failure already. Will you make the effort?" He looked at me for a moment and then said: "Yes, I will make the effort if you think it will do any good." And he made the effort and has succeeded, and that boy can laugh today. I think that perhaps the only really effective thing I ever did in my educational work was to induce that boy to cultivate an agreeable manner. He came to me a short time ago and discussed what he is going to do in the future and is anxious to make the most out of life. In connection with our work we must teach these things.

And there is something else we must do. We must try to cultivate in our boys a love for the things that are good. An American poetess died a short time ago. Some people thought she was great and some thought she was a little giddy, but in one of her poems Ella Wheeler Wilcox wrote two lines that I think are very significant. When a mother commits her child to the care of another, the author represents her as saying:

"Teach her to live in hate of hate and
love of love
To gain an entrance to the realms
above."

And that is the way we should teach literature. Use good English, write good English on the board, draw the attention of the students to beautiful things, teach them to love and to see the beautiful, and after awhile they will begin to appreciate and to follow it.

I have just one word to say in conclusion. Our students are conscious of the change that is taking place in the profession of dentistry and they are expecting greater things in the future than have been done in the past. And as I thought of that subject and listened to Rev. Barkley quote the Scripture this morning, I was reminded of Holden Hunt's great picture—"The Light of the World"—which I saw one day in St. Paul's Cathedral, London. Christ is shown standing with a lantern and saying, "Behold, I stand at the door and knock, if any man will open the door I will come in and sup with him and he with me and we shall have fellowship one with the other." The dental students are standing at the door and knocking. In the picture the peculiar thing about the door was that there was no handle on the door, it could not be opened from the outside, and then, too, it was all grown over with beautiful vines and flowers, covered with attractive things, and these would all have to be removed before the door could be opened. And that is the way it is with our students today. The world is full of things that are attractive to young minds. The best things of life, the essential things of life, have been made very dear, and the commoner things

of life have been made very cheap. I remember that when first married we could buy a dozen eggs for ten cents, but in the city we had to pay $2.50 to go to the theater. Now we have to pay upwards of $2.50 for a dozen eggs and can go to the theater for twenty-five cents and see the best the world has to offer. And this fact is tending to call the young people away from the essential and valuable things of life. We must show them what is worth while, teach them to place the essential things first. In other words, we must uncover the door, take away these unpractical and seductive things. The door can be opened only from the inside, and we who are on the inside of dental education must open it and ask our boys to come in that they may have fellowship with maturer minds, and then send them out with a vision of their life work.

H. M. Semans, Columbus, Ohio: President Bunting's address is of a very healthful and interesting nature, owing to the fact that he and his Executive Committee have taken the suggestion in President Thornton's address last year asking for principles in teaching rather than methods of teachings. Close attention to the program which will be presented at this meeting will show us a decided departure from the proceedings held in the past, and I am sure that as a result we shall feel very grateful to President Bunting and his Executive Committee.

I have noted two or three points in this address which I would like to touch upon. President Bunting says: "No longer is she solely concerned in the mechanical and technical procedures, but rather has she entered the field of speculation in which her primary interests are the conservation of the health of the patients."

It might be of interest to us all to know that a new line of work is being undertaken in several universities, which contains a course of four years leading to a degree of Bachelor of Science in Applied Optics. This course in applied optics is offering theoretical and practical knowledge and application of optical principles of the correction of visual errors with clinical practice in both refraction and pathological fields. If you substitute the word "Dentistry" for "Applied Optics," there is no difference between this course and our present four-year course in dentistry. Under the laws of the various states this grants to the holder of the degree the right to apply simply the mechanical part of correction of the eye trouble. Yet we today, as dentists, work in correction of the pathological conditions concerning the teeth. Can we consistently allow ourselves to conduct our course of dentistry practically parallel to the four-year course in "applied optics," demanding and expecting our graduate to assume a broader and larger field of work, made larger by our treatment of the pathological condition, whereas, on the other hand, the world-at-large does not and cannot grant the same privilege to graduates in applied optics?

The President's address is of the kind that is pleasing to us all because of the fact that it is an elaborated preface to what is to follow. I wish to commend him for making the latter part of his address a call to the larger and better things to come in the whole scope of dental college teaching.

NEED AND MEANS OF EDUCATING LABORATORY ASSISTANTS

By VICTOR H. SEARS, D.D.S., Salt Lake City, Utah

(Read before the National Dental Association, Boston, Massachusetts, August 23-27, 1920)

MANY a dentist can recall his feeling of helplessness at the sight of his first plate patient and the critical period of suspense when he placed the completed denture in the patient's mouth. This feeling of anxiety and apprehension was due partly to the fact that his college training in impression and bite-making was incomplete and partly to the fact that the denture was completed in a commercial laboratory, which had always been pictured to him as an institution of the devil.

Without seeking to place the blame upon anyone, it should be said that the attitude of our educational institutions with respect to mechanical dentistry has not been, and still is not, in keeping with the spirit of the times. On the contrary those institutions have been most derelict in this regard, and as a result American dentistry, whether we fully realize it or not, has suffered. Let those who direct the educational progress of our profession apply the remedy. Our dental colleges have a definite and urgent duty to the profession—the duty of educating laboratory assistants.

If one wishes to learn stenography and typewriting, there are schools in all parts of the land equipped and organized to give him the necessary training. It is not difficult to obtain schooling in automobile repairing and in other lines of vocational training; but if one wishes to learn prosthetic dentistry he has no such opportunity. The chances are that if he succeeds in finding a school, the training will be superficial and without that balance and completeness which the importance of the work demands. We must not lose sight of the fact that positive harm often results from incorrect teaching, and this is particularly true of such matters as prosthetic dentistry, wherein the student cultivates certain habits which are more easily learned than forgotten. Therefore let us make it easy for the prospective laboratory assistant to find a school in which he will be correctly taught.

Seeking a place in which to secure training in dental laboratory technic, one naturally—and without knowing the situation as it really exists—would turn to the reputable dental college. But here he would meet with disappointment. It is a sad commentary on the otherwise fair name of American dentistry that the fountain heads of learning have not met the demand for this particular branch of important and essential instruction.

There are at the present time whisperings about courses for laboratory assistants in the regular dental colleges. When questioned by letter some of the men in charge have answered in effect: "Yes, we have considered the training of laboratory assistants but at present our plans are not complete, so please do not say anything about it." There seems to be a feeling that it *must* come, but

there is no haste on the part of the colleges to take the initiative.

Aside from the dental colleges, there are several ways in which the laboratory assistant might more or less satisfactorily obtain his information and training; let us consider for a moment some of them.

1. Most of us who want laboratory assistants train them ourselves, and while this method has some advantages it is not a highly effective means of accomplishing the desired result. Its disadvantages are known to all of us who have attempted it—so well known, indeed, as to require little discussion here. Were there no other objection we cannot escape the question: Why should we be required to devote the time and energy from our work to watch a laboratory assistant and bring him up in the way he should go, and perhaps have him leave about the time he is becoming successful? One may as well ask the highly specialized expert in any profession or trade to use a large part of each day in teaching the apprentice fundamentals. There is no economy in such a process. If laboratory assistants could come to us already trained—and they could, were proper provision made for them—the saving in time and energy and the benefits from every point of view would be almost immeasurable.

2. There are a number of so-called schools for mechanical dentistry, and theoretically the idea appears reasonable; but at present these places, so far as one may judge, merely exploit the credulous and fill him with the hope of big returns for a slight expenditure of effort and energy. In these so-called schools for mechanical dentistry it appears that the instructors should first learn before attempting to teach. In the light of results thus far achieved we can safely rule out the "school of mechanical dentistry" as a means of training assistants.

3. Another means by which the prospective laboratory assistant could receive his education is by means of dental textbooks and journals; but there is a crying need for textbooks suitable to this purpose, and the journals cannot be expected to do much more than to build upon existing knowledge. Books and journals should by all means be used, but we cannot, in the very nature of things, depend wholly upon them. Woe to the dentist whose assistant has obtained his education thru correspondence or thru the printed page alone!

4. Exhibition models might be, and should be utilized in the study of the various steps of technic. Much time can be saved by models showing the stages of construction step by step. But here again it is the province and the duty of the dental college to supply the models so that they would be accurate and dependable. It would not be practicable for the individual dentist to make all of the necessary exhibits, even if he wished to do so.

5. Another possible means of educating the laboratory assistant is thru the supply houses and the commercial laboratories. This is being done now in a limited way. And here—let us make no mistake about it—the profession faces a danger if not an actual menace. If the colleges continue to neglect this important phase, we may be sure that the supply houses and the commercial laboratories will seize their opportunity and take the upper hand. They will undertake to *control* this branch of the profession and teach that which the college should teach, just as they have undertaken to teach us in financial matters.

Aside from the problem of assistants for our offices there is the problem of putting competent workmen into the commercial laboratory, and this is of as much importance to us as it is to the laboratory, perhaps more so.

The reputable laboratories are always seeking skilled workmen but are frequently forced to employ persons of little skill with the hope of "breaking them into the business." During this "breaking in" process we and our patients must suffer. The commercial laboratories are

not entirely to blame; neither are the workmen. The fault lies with our present system or lack of system for training workmen.

What, then, is the conclusion? We must look to the dental colleges as the logical source of education for the laboratory assistant, if the profession is to maintain its high standard and move forward to its high destiny. Incidentally it does not seem to have occurred to the dental colleges that the conducting of courses for dental mechanics would open up a new and very desirable field for prospective dental students.

Possibly the fact that the colleges have not generally undertaken the education of assistants may now be turned to advantage if the colleges will quickly decide upon a definite, standard curriculum, and if they will work in unison.

We are coming to standardization of teaching and of technic in dentistry as well as in the industries. It will be far easier for the dental colleges to start out with a common standard and keep together than it would be to begin independently and later harmonize the courses. There is no way by which we can more quickly and more effectively attain a standardization than by instructing the embryo dentist and the laboratory assistant under the same roof and by the same, or correlating, instructors.

Perhaps there is already an organization among the dental colleges which could prescribe the kind and amount of education necessary to train the assistant in the quickest and most positive manner. If not, one should be organized. This will require a committee of broad-minded men who have no hobbies, no personal methods, and no special apparatus to thrust upon the unsuspecting novice.

Every laboratory assistant need not know all branches of prosthetics. Instead of graduating men from a course in mechanical dentistry we should issue certificates for each branch taught. Thus a person could present himself at the college for a course in crown and bridgework, and upon having received the necessary training be issued a certificate which would be notice to the dental profession that the bearer had received the standard, recognized training deemed necessary to qualify him to hold a position in one of our offices or in a dental laboratory. The same person might also qualify in plate work or in any other branch of prosthetics and receive his certificates to that effect. With standardization of technic and a common curriculum we could know at once the value of these certificates issued by any recognized dental college in the land. It might even be advisable to license competent workmen as a means of protecting ourselves against inferiority. We require a license from the person who fills prescriptions. Even a barber must obtain a license before he is permitted to wield a razor and serve the public. Why not require a definite minimum of efficiency from the laboratory assistant before permitting him to make plates and bridges? A suitable training in college would give him the necessary efficiency.

It is not for the practicing dentist to tell the colleges just when and how the courses shall be conducted nor to prescribe the technic; but it might be suggested that the colleges can get some very practical help thru co-operation with the commercial laboratory men. This may seem to some like the lion and the lamb lying down together, but the college professor will learn that the laboratory man is somewhat of a lamb, just as the laboratory man will learn that the college professor is not such a lion after all. The antagonism of the past has been due to the fact that the antagonists have been neither lions nor lambs but have more closely resembled a braying animal with large ears and a stubborn disposition.

Whether we regard the commercial laboratory as a benefit or as a necessary evil, we must recognize the fact that it

is here to stay and that only a small percentage of the practicing dentists will do all of their own laboratory work in their own offices. Many, if not most, of the dental colleges give their students the impression that the commercial laboratory should be shunned. This attitude must and will change. Lawyers recognize and utilize the work of abstractors, even tho the abstractors are not admitted to the bar. Physicians recognize and make use of the bacteriological laboratory in which the work is done by persons who do not possess M. D. degrees, but who nevertheless are capable of getting more accurate results with less expense than is possible for the practicing physician with average training, experience, and equipment.

In just such a way should we recognize the benefit from the reputable dental laboratory. If we give recognition to the commercial laboratory, we may expect to have a voice in prescribing how it shall be conducted and in determining the standards it should maintain. Moreover, and of even greater importance, we can teach the student what to expect from the laboratory and just how to get the best service from that part of the work which is not done by the operator himself. By establishing a standardized technic, known and adhered to by the dentist and by the laboratory, we can without question obtain more satisfactory results, and we ourselves, our patients, and all concerned will greatly benefit thereby.

At first thought this may seem like rank heresy to those who in the past have looked upon the commercial laboratory as an institution of the devil designed to lead good dentists from the straight and narrow path. Even granting that Satan himself is backing the commercial laboratory, let us be prepared to show our graduating dentists how to utilize the institution, for the great majority of of them will "go to the devil" anyway.

The more we study this matter the more we shall be convinced that the contention herein set forth is logical and reasonable, based on conditions as they actually exist and the situation that confronts us. If there is a better solution of the problem, no one seems to have pointed it out. The lessons of the past, our successes and failures, should teach us to take advantage of the opportunity which now presents itself. The laboratory is not a mere casual adjunct of our profession—it is a vital, integral part of it. Let it be repeated, even at the risk of seeming monotonous, that the only logical and safe place where one should receive the fundamentals of dental laboratory technic is in the dental college.

THE PORCELAIN VENEER CROWN VIEWED FROM THE STANDPOINT OF A FINE ART

By WILLIAM D. VEHE, D.D.S., Minneapolis, Minnesota

(Read before the National Dental Association, Boston, Massachusetts, August 23-27, 1920)

THE dental literature on the subject of the porcelain veneer or jacket crown reveals an abundance of material, especially so in recent years since porcelain is again coming into its own. The literature that is at our command very ably sets forth the technic for the construction of the crown according to that developed by the different writers. Nowhere, however, do we find much attention given this subject from the standpoint of art, in fact the emphasis has been placed entirely on the mechanical phase of the work.

At this time when the profession is more fully appreciative of the veneer crown and because science and art are inseparable in this work, it seems proper that the subject should be treated more broadly than heretofore. In our enthusiasm there is danger that we undertake this work without a sufficient preparation for it or a proper appreciation of its artistic possibilities. It is not enough to have a thoro knowledge of the mechanical processes even tho it is the foundation. If one is to rise above the mediocre worker it is necessary that he broaden his conception of the work; it is essential for him to train his mind to see what he should look for. "The eye only sees in things that which it looks for and it only looks for that of which the mind has already formed the idea."[1] Our mental processes are not unlike our digestive tract in that material taken into either which is not assimilated is of no value whatsoever; in fact it may be harmful. When the time comes for material to become digested, then the benefit begins. On the other hand when we have a disposition to ridicule what does not come into our experience and what we do not understand, then we begin to stand in our own light.

I am sure we are agreed on the ideal that it is our intention to carry out. Instinctively, almost, we feel that it is our purpose to exactly reproduce nature as we find her. We must observe and preserve harmony, and in so doing it is necessary to recognize the individuality of each tooth and to reproduce it as fully as our development will permit.

The workers in porcelain, oil, and marble have much in common and perhaps a more intimate comparison would not be amiss. It *must* impress us to appreciate, viewed from our angle of kindred artisans, the thoroness of preparation and of technic necessary for such serious work. We have not the same latitude as has the worker in oil or marble in that we cannot idealize, except in very rare instances, for we must necessarily reproduce variations, markings, and even imperfections; in fact it is required that we copy so accurately as to conceal our own handiwork. This statement at once reveals our limitations and implies that we reproduce true color in the restoration together with the individuality of form.

Possibly no other man in the profes-

[1] Peiss, Modeling by Lauteri, III, 71.

sion has given the subject of tooth color as much attention as has Dr. Forrest H. Orton. He states that the foundation of tooth color is the dentin influenced possibly to an extent by the pulp and that this is a hue of orange with the addition of white and black values in the Caucasian race. He states, further, that "normal enamel can be expected to contribute only white or brightness value" and that the other colors observed in many cases are due to the phenomena of simultaneous contrast, successive contrast, and negative after-images. I am quoting him because my experience thus far bears out his findings.

Had we only normal teeth to deal with our color problem would be much simplified, but our difficulties are increased when the enamel, and in many cases the dentin, becomes stained, as often occurs in later life. These are the cases that then become more complex and that require our most careful color discrimination and mental concentration to obtain an accurate analysis.

Obviously the painter of a portrait or a landscape must first of all observe the true colors in nature that he wishes to reproduce on his canvas. His color discrimination in this respect must be entirely accurate. He must next be able to interpret nature's colors in his own colors, and in doing so he must take advantage of the possibilites of his canvas and and brush and fully recognize certain definite principles of color and psychological influences. In other words, he must become the master of his colors. The worker in porcelain must proceed in a very similar way. He too must see the true colors in nature, in his case the color of the natural tooth. To be accurate in this he must develop his powers of observation so as to accurately discern the correct hue and the finer gradations of the color and fully recognize the principles of color and psychological influences.

To illustrate what this latter statement implies, permit me to speak of some of the influences involved that are not so well understood. Light, of course, is the foundation of all vision and the retina or optic nerve the means of our perception of the same. The impulses that pass from the retina over the optic tract to our visual centers are possibly never fully perceived for the reason that we see only that of which we have formed a previous idea. Certain impulses are wrongly perceived when focussed on the retina so that we see them differently from what they really are as expressed in nature. We know this to be true because when these same objects are placed in different environments they appear differently.

In viewing colors there are certain definite changes produced in sensation which psychologists recognize as contrasts and after-images. These sensations can be easily demonstrated and the effects observed. For instance, if two different colors, as red and green or blue and orange, are placed side by side, each of the colors will appear more saturated at the line of junction. This phenomenon is called a simultaneous contrast. The retina easily becomes fatigued and changes in color perception are then called negative after-images. We can demonstrate these after-images by looking intently at a black or white field and, when closing our eyes, we will perceive a white or black image respectively, or by looking intently at a color and then focussing on a colorless field an after-image can be observed which, in every instance, will be the complementary color of the color viewed. Blue will produce an image of an orange tinge, and red a greenish tinge. In viewing different colors in succession, contrasts are produced that may be favorable to the colors viewed or otherwise, depending on the after-image that is superimposed on the color next seen; for instance, in looking at a red and then a green field, the green will appear more saturated and brilliant for the reason that in looking at the red, the after-image will be a green-

ish tinge and the green would be strengthened accordingly. On the other hand, were we looking at a red and then at an orange field, the effect would be different for the reason that the after-image from viewing the red would be greenish, which would render the orange more yellow or, if the orange is of a low tone, of possibly a greenish tinge. The former phenomenon is known as a successive contrast and some writers speak of the latter as a mixed contrast.

In viewing a tooth in the mouth similar influences may be encountered. The teeth being surrounded by the more or less red oral tissues, because of contrast, may appear as yellow or even of a greenish tinge instead of an orange hue, as one could not help perceiving were the tooth viewed out of the mouth. This same phenomenon may be experienced in viewing the incisal or occlusal portion of a tooth, especially when the tooth has a high orange saturation, in that it may appear as having or being of a bluish tinge. This is because gray, when placed along side of a color, is rendered as the complement of that color. This shows us that we may have been somewhat deceived in many of our cases and we must guard ourselves against such error.

The kind and amount of illumination have much to do with a correct color perception. Colors viewed under artificial light appear different than in daylight, depending also on the kind of artificial light, and the intensity of the natural light makes a difference likewise. Increased intensity of illumination will render colors lighter and finally as white toward the red end of the spectrum while the blue end will be rendered as gray. Decreased illumination has the opposite effect in that colors are rendered darker and finally as black. When we again call to mind that the colors we see are really the rays of light that are not absorbed by the object but are reflected or thrown back, we can better understand this influence, but here again is another modifying factor which is the condition of the surface of the object. An object having a smooth, even surface is lighter in color than one of the same color with an uneven surface, and there are other surface conditions that are equally as important.

Probably the most desirable light under which to make a color analysis is a well-diffused, natural light of average intensity. Under such conditions of light we see the tooth more as it is generally noticed. While studying the color of a tooth in the mouth, preparatory to making a color analysis, it may be of advantage to cover the oral cavity with a gray-tinted sheet of paper into which an aperture has been cut to permit a view of only the crown of the tooth. When this paper is held well against the teeth and oral tissues, only that tooth from which the color selection is to be made is visible without being influenced by the surrounding area.

In the interpretation of a tooth crown in our porcelain bodies there are certain factors to be taken into account the neglect of which will render an inaccurately colored restoration. Varying thicknesses of porcelain of the same color will have different degrees of saturation and especially should too thin portion be guarded against. Uniform building of the body and an accurate, uniform fusing is also essential for good color effects.

The porcelain worker must become entirely familiar with the working qualities of his porcelain and the potentialities of his colors; in other words, he too must become the master of his colors. The selection of color and its interpretation are as scientific as any part of the technic, and a careless indifference in the color selection or a misinterpretation can result only in indefinite effects and many failures.

Accurate color discrimination cannot be developed at once, and we should not expect to master this faculty except thru careful application and observation. Under such discipline the eye is finally able to discern the finer gradations of color;

the mind will unfold to fuller understanding, so to speak, and the powers of observation will become intensified.

True color perception and interpretation alone do not make the artist in oil any more than the same qualities alone make the artist in porcelain. It is true that they are the qualities necessary but there are others just as essential to make his work a masterpiece.

The worker in porcelain must also observe true form and outline, and in this respect his work simulates that of the sculptor, but while the sculptor does not need to concern himself with color, the porcelain worker necessarily must. The sculptor, to do serious work, prepares himself by making an intimate study of nature, and his work is with the aid of a model. The sculptor in porcelain, to do serious work, must likewise make an intimate study of nature even tho in a more restricted or specialized sense. He must become intimately familiar with tooth form and not content himself with what he believes to be true anatomy from his memory of the subject as taught him in college. The study of the natural teeth is the only way in which to obtain this knowledge, and such a study proves to be not only most interesting but is as well the foundation for the correct interpretation of form. It prepares him to see that for which he should look. It is not to be denied that a study of the theory of color and a course in drawing and modeling would be a desirable assistance in the preparation for this work.

In actual work it is rarely sufficient to shape a restoration from the knowledge we may possess of what the true form should be, no matter how accurate that knowledge may be, but a model should be used as our guide, in this instance a cast sufficiently extensive to facilitate the reproduction of the individuality of form. The restoration should be harmonious in every respect. This cast which is our guide should be accurate and the true surface inequalities and fine markings should be preserved.

There is no phase of this work that is so enjoyable as the expression of our aesthetic nature. However, it is not for this satisfaction nor alone for art's sake that this carefulness of technic should be insisted upon, but also for the purpose of establishing function and maintaining tissue health. Porcelain lends itself to the highest artistic possibilities. Whether we are able to fully realize these possibilities lies entirely with us for we are limited only by ourselves. True art in this work is essentially individual.

I purposely have not spoken of the technic involved in the mechanical part of this work except where art was involved for the reason that I have already given. I do not wish to be understood as belittling it nor do I believe that this subject is too far above it to be considered at all, but because technic is a method or style of procedure, it is essentially necessary and without it there could be no art.

When considering the veneer crown we can have no other purpose in mind than to produce a true and complete substitute, an accurate likeness; and no matter how exact may be one's technic otherwise, if it does not include a careful and correct color analysis and its interpretation, together with individuality of tooth form, it will be incomplete and fail to produce this true harmony. Our finished piece must become a matter of interest and comfort to both the patient and ourselves, and who can say that the restoration of features otherwise beautiful, or the preservation of the same, is beneath the dignity of our highest purpose.

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THE JOURNAL of the NATIONAL DENTAL ASSOCIATION

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Editorial Department

THE CHALLENGE OF THE NEW YEAR

To thoughtful men the first days of months or years are more or less sobering in their effects. The balancing of accounts, a face to face contract with liabilities and assets, a fearless summary of gains and losses require a heart strength that manifests manhood. The making of resolutions is not utterly childish; nor is it without virtue for the older person. The facts are that the yearly addition and subtraction process with consequent resolutions are perfectly sound business meth-

ods. And with the formulation of resolutions must go a study of present conditions that will enable one to some degree to anticipate the yet unseen occurrences of the oncoming days.

To most of us the review of the year means a review of the tangibles of the office. It means a search for leaks and wastes with determinations to conserve. It means an adjustment to the changes that we observe in terms of charges and expense. There is something of self-examination too for the purpose of standing more firmly for what we call our rights when in the parley of contract setting we have felt ourselves less courageous than we should be. We argue with ourselves concerning the installation of some equipment that might aid our efficiency or the impression that we desire to make. And with these considerations our study ends.

For the moment let us forget the balance sheet and the schedule of prices, the corporeals of the office, and consider in our plans for the new year some of the imponderables that deserve attention. Dentistry is more than a means of making a living and the dentist is more than a man who has a living to earn. It is because of this concept of both the calling and the man who plies it that both have inherited criticism and comparison not pleasing to the ears. If they are not more than that it is a question whether the art of dentistry or the practitioner of it has a claim whatever. Before us must come the vision of dentistry as an integral part of the great whole of the science and art that like the leaves of the tree of life are for the healing of the nations, and with it must come the practitioner as a man of ideals and motives raised far above the madding struggle for dollars or plaudits only.

There is no phrase oftener heard than "preventive dentistry." We discuss organization for the accomplishment of the purpose; we appoint committees for the determination of ways and means to that end; we delegate men with ready tongues to proclaim the evangel of oral sanitation. Dentistry, like other exalted professions, has attempted to wholesale what can best be retailed only. Dentistry has followed the lead of others in trying to accomplish its virtues by delegation and representation. Following the lead of a misleading proverb but in this instance voicing a truth, we would urge that this thing best begins at home. It is at his chair that a dentist wields his sceptre. It is there that he is influential and effective. It is there that his words have the greatest weight. It is there that he lives out the essence of his title for does not doctor mean teacher? Mark Hopkins on a log and a boy beside him has been given as a definition of a college. The dentist's office is, or should be, the college of preventive dentistry.

We believe in mottoes stamped preferably on the consciences of men.

Vote for this one, "preventive dentistry." We are convinced that it will put acumen to the mind and cunning to the fingers. It will of necessity make a student of the man who before studied little or not at all. It will expand his vision until he will see his patient as a closely organized whole rather than a composite of independent parts, and in his ministrations he will act with multiplied care because of the complexity and delicacy and value of the organism at his fingers' ends. Sensing somewhat the responsibility of his task, he will be more than a dental surgeon, more than an oral surgeon; he will be a physician in a startling reality. And this will mean the care of prescription writing in his laboratory procedures and the solicitude of the family doctor in his restorations.

At this point many of us feel a wave of resentment because of positive inability to cope with the responsibilities that confront us. We have acquired an ability that is in itself a superstructure but is limitedly serviceable because of poor foundation. To ourselves we have often voiced denunciation because the fundamentals necessary to understanding and diagnosis were unknown to us and we have wished for the opportunity to familiarize ourselves with them, but it is too late. The inadequacy of our educational program is to blame. In our hearts we know it. Our profession has never seriously considered this cornerstone of our temple. Politics and individual ambition have too often swayed and retarded the dental educational process. True enough, much sincere effort has been spent upon this problem but the whole was rendered an ineffectual dilution by the amount of personal or corporate interest always present. This could scarcely have happened had we considered the very fountain of supply as an interest in our affairs. Individually and collectively we have stood aloof with scarcely a glance schoolward, from whence were to come the men who should maintain and advance the interests of the profession. Educators are often heard to say that dentists are not ready for an educational advance, and doubtless they say it with much to support the statement. It is obviously true that dental education has not kept pace with that of the other professions, and the reason is obvious. A multitude of specious arguments are advanced to keep it in its inadequacy while our own inefficiency and the need of those in our care cry aloud for trained men, for better men than we ourselves are to come to their help.

The new year will present its problem as did the old, which we shall attend to because of their intimacy. It will also present with more urgency these to which most of us are strangers and ask attention. In dentistry as in citizenship the day is past when men can find plausible excuse for disinterest and inactivity. While in the seclusion of our

offices we must not forget that we are responsible parts of the great whole and our burden is greater than the passing duties of the chair and laboratory. Dentistry, as it concerns education and safety of men and women, and as it concerns the great program of dentist production, is the concern of every man and asks a thought in the list of resolutions for the New Year.

DENTISTRY MANIFESTS TRUE CHRISTMAS SPIRIT

The Relief Fund Committee is to be congratulated on the effort it manifested and the result it obtained in increasing the permanent endowment this Christmas. This fund will reach a total of seventy-five thousand dollars in the near future.

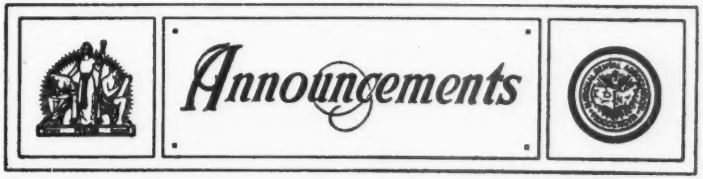
The committee desires to express its sincere thanks and appreciation to all the donors who have so loyally contributed thru the sale of Christmas seals. However, a careful review of the Relief Fund ledger shows that there are a large number of members who failed to contribute to the fund or return the Christmas seals. In a forthcoming issue of *The Journal* there will appear a list of contributions to the fund according to states. Some states will not be proud of their record. There are many who, thru neglect or oversight, have not contributed to this cause and we would especially urge these members to send in their check immediately as it will save time and expense in writing personal letters.

Thru this fund the dental profession will be able to say it with flowers when the proverbial rainy day comes into the lives of some of the worthy members of our profession.

MEMBERSHIP DUES DUE JANUARY 1, 1921

All dues, which include the annual subscription to *The Journal of the National Dental Association,* are due January 1 of each year. The March *Journal* will not be mailed to any delinquent members. The ruling of the post office authorities is adamant on this proposition. Therefore any dentist who has not already paid his state society dues for 1921 should do so immediately. The state society officers are co-operating with the national organization and will immediately, on receipt of the state dues, mail the national dues to the national office.

It will be impossible for us to furnish back copies, as we are printing only enough to supply our bona fide mailing list. An immediate compliance with this notice will save the delinquent member a great deal of confusion and misunderstanding. A delinquent member is one who does not have his 1921 membership card.



AMERICAN INSTITUTE OF DENTAL TEACHERS

The next annual meeting of the American Institute of Dental Teachers will be held at the Claypool Hotel, Indianapolis, Ind., January 24th, 25th and 26th, 1921.

The program will contain much of interest in dental teaching methods and dental educational affairs. A cordial invitation is extended to all ethical practitioners and others interested along these lines to attend the sessions.

DR. ARTHUR D. BLACK, *President*
DR. ABRAM HOFFMAN, *Secretary*
381 Linwood Ave., Buffalo, N. Y.

IOWA STATE DENTAL BOARD

The Iowa State Board of Dental Examiners will meet for the purpose of examining candidates for a license to practice in Iowa, at Iowa City, College of Dentistry, beginning Monday, February 7, 1921, 9:00 A. M.

For further information and application blanks, address,

DR. C. B. MILLER, *Sec'y*
726 Fleming Bldg., Des Moines, Iowa

NEW MEXICO BOARD OF DENTAL EXAMINERS

The New Mexico Board of Dental Examiners will hold a meeting in Albuquerque, beginning February 7th, 1921, for the examination of applicants. All applicants must take the examination. For blanks and rules governing examination address,

M. J. MORAN, *Secretary*
Deming, New Mexico

CENTRAL DENTAL ASSOCIATION OF NEW JERSEY

The Central Dental Association of Northern New Jersey will hold a mid-winter educational meeting at the Robert Treat Hotel, Newark, New Jersey, during the first week in March. All the prominent dental manufacturers and dealers will exhibit. The clinicians and essayists will be from among the best in the country, and the meeting promises to be one of the most successful and largest attended ever held in Northern New Jersey. Further notices of the exact time and the names of the men who will clinic, and the program complete will appear in later issues of this publication.

HENRY J. GIBBONS, *D.D.S.*
Chairman Executive Committee
221 S. Orange Ave., Newark, N. J.

KENTUCKY STATE DENTAL ASSOCIATION

The next annual meeting of the Kentucky State Dental Association will be held in Louisville, Kentucky, April 13, 14, 15, 1921, with headquarters at the Seelbach Hotel. A clinical program of unusual interest is being arranged.

Address all correspondence to

W. M. RANDALL, *Secretary*
1035 Second St., Louisville, Ky.

VERMONT STATE DENTAL SOCIETY

The Vermont State Dental Society will hold its next annual meeting in Rutland, on Wednesday, Thursday, and Friday, March 16 to 18, 1921.

H. B. SMALL, *Secretary*
Burlington, Vermont

KANSAS STATE DENTAL ASSOCIATION

The next meeting of the Kansas State Dental Association will be held in Wichita, Kansas, March 21, 22, 23, 24, 25, 26, 1921. The first two days will be for open meetings, the remainder for postgraduate work.

C. K. WEAVER, *Secretary*

MICHIGAN STATE DENTAL SOCIETY

The next annual meeting of the Michigan State Dental Society will be held at the Hotel Statler, Detroit, April 11-16, 1921. William H. Elliott, 7643 E. Jefferson Ave., Detroit, Michigan, is chairman of the Program Committee. W. H. Waller, 613 Washington Arcade, Detroit, Michigan, is in charge of exhibits. W. A. Cook, 422 McKerchey Building, Detroit, Michigan, is in charge of hotel reservations.

CLAUDE S. LARNED, *Secretary*
614 Post Bldg., Battle Creek, Mich.

IDAHO STATE DENTAL EXAMINATIONS

The next examination for dentists will be held on July 12, 1921. For application blanks and full information concerning this examination, address Bureau of License, Boise, Idaho.

PAUL DAVIS, *Director*
Bureau of License

ALUMNI SOCIETY OF THE DEWEY SCHOOL OF ORTHODONTIA

The next annual meeting of this society will be held on April 25 and 26 at the Hotel Ambassador in Atlantic City. The usual high standard of the meetings of this society will be maintained. Clinics and evening sessions will be included in the program. All interested in orthodontia are cordially invited to attend these meetings.

GEORGE F. BURKE, *Secretary*
741-43 David Whitney Bldg., Detroit, Mich.

ANNUAL CONVENTION OF THE TEXAS STATE DENTAL SOCIETY

The Texas State Dental Society will hold its forty-first annual convention on Thursday, Friday, and Saturday, March 3, 4, 5, 1921, at Dallas, Texas.

The Executive Committee is endeavoring to make this meeting an unusually attractive one, and to that end will not only utilize the best talent of the Society, but will bring in a few outside men of note. Clinics will be made a prominent feature.

On Monday following will commence the Society's second annual postgraduate class course, to continue one week and which will be conducted by the following instructors: Dr. Rupert R. Hall, Chicago; Dr. F. Ewing Roach, Chicago; Dr. T. W. Maves, Minneapolis; Dr. Arthur E. Smith, Chicago; Dr. Thomas B. Hartzell, Minneapolis; Dr. Clarence C. Simpson, St. Louis.

J. G. FIFE, *Secretary*
Dallas, Texas

DISCRIMINATION AGAINST ARMY DENTAL OFFICERS

Members of the commissioned personnel of the Army dental corps feel that an invidious distinction is being made against them by the War Department in the refusal of the Secretary of War to act favorably on the protest which was recently made by the surgeon general of the Army in the matter of the provisions of paragraph 1272, which specifically excludes "dental surgeons" from the list of officers required to be mounted. No other officers of the Army are thus descriminated against, and it was hoped that as a result of the experiences of the World War it would be appreciated that dental officers were as much entitled to be mounted and that their duties required them to be mounted to the same extent as their associates in the service. The logical result of the decision is that a dental officer attached to a mounted command must find his own means of travel or walk; the government makes no special provision or gives no authority for mounting him. To be sure, the commanding officers may be counted upon to provide transportation rather than see the dental officer lagging behind the column, but there is nothing in the regulations to justify such a humane action, and there is, on the other hand, a provision in the regulations which seems to prohibit it if followed by a stickler for rules as they are written. No one appears to know why the dental officers should be placed in a class by themselves in this particular, but there they are, with little chance, apparently, of getting out of it for the present. It is obvious that this situation is a veritable handicap for the dental corps, as General Ireland has pointed out, and to that extent diminishes the usefulness of the branch, the availability of which in preservation of Army health and relief, it is felt, should not be improved in this way. The corps still lacks its authorized commissioned strength, three recently appointed officers having declined commissions. Four reserve officers have been called to duty—Captain W. W. McCrillis, assigned to the 9th corps area; Captain W. B. Williams and Lieutenant M. H. Moens, to the 8th, and Captain G. C. Gentry, to the 6th. There are now 38 vacancies, of which 34 may be filled temporarily by calling into active service that many reserve officers, who will be available for duty until June 30, 1921. —*Army and Navy Register, December 11.*

ARMY MEDICAL DEPARTMENT

There are 612 vacancies in the Army medical corps and 41 vacancies in the dental corps. In the former 113 candidates of the emergency personnel qualified for appointment, and of these 20 have so far declined following the October examinations. There are 75 applications on file to take the examination of candidates from civil life, which examination will be held within the next month or so, as soon as the War Department publishes the new regulations governing such events. Some question has been raised as to the advisability of permitting the emergency personnel candidates to be examined and appointed during the next few years, in view of the large number of vacancies in the medical corps, prevailing to an extent which will be found impossible to fill from among graduates of the medical colleges. This could be done by direction of the President or Secretary of War, as there is nothing in the law that limits the period during which these emergency Army officers are eligible for appointment to various grades. In this branch of the Army such appointments do not in any way interfere with the promotion of officers, since advancement to the various grades is in accordance with length of service prescribed by statute. During the past week the Secretary of War has modified previous instruction in regard to the assignment to active duty of medical reserve officers. This particularly relates to those who are assigned to duty with the dental corps, 34 in number, who, under the original memorandum, were to be below the grade of major. This has been changed so as to have not exceeding six of these reserve officers of the grade of major with the remainder below that grade, and with the further understanding that the total number in the dental corps, regular, emergency and reserve, shall not at any time exceed 298. In the medical corps of the 50 reservists not more than 20 per cent will be of the grade of major and the remainder below that grade. The surgeon general of the Army has prepared, as usual, a number of important recommendations concerning new legislation for the medical department, but it is understood that the War Department has decided that no proposals of this character shall be submitted to Congress for action during the present short session. —*Army and Navy Register, December 18.*

DENTAL CORPS ORDERS FROM WAR DEPARTMENT

Captain Oliver J. Christiansen, First Lieutenants Herman J. Lambert, Jay R. Haskins to 7th Division, Camp Funston, Kans., for duty.

First Lieutenant Clarence C. Olson from duty at Fort Snelling, Minn., to Fort Des Moines, Iowa, for duty.

First Lieutenant Stanley R. Rayman from duties at Camp Lee, Va., to Camp Dix, N. J., for duty.

Major Robert B. Tobias, from duty at Camp Upton, New York, to Camp Benning, Georgia, for duty.

Captain Fernando E. Rodriguez from duty at San Juan, P. R., to Army medical school, Washington, for duty.

Resignation by First Lieutenant Ralph E. Morgan accepted.

Registration by Captain James H. O'Reilly accepted.

The following appointed to dental reserve corps with the ranks and ordered to duty at places indicated:

As captains: Richard F. Doran, Hoboken, N. J.; Clarence A. Flanagan, Camp Kearny, Cal.

As first lieutenants: George E. Pendarvis, Rockwell Field, Coronado, Cal.; Arthur F. Bokman, to Columbus Barracks, Ohio; Henry L. Gilmour, Jr., Camp Humphreys, Va.; George W. Riche, to Camp Sherman, Ohio; Earl Stafford, Fort McPherson, Ga.; George C. Sanderson, Fort Williams, Me.; William H. McDonald, Fort Ringgold, Tex.; Clarence E. Wisecup, Fort Sam Houston, Tex.; Fay T. Bowen, Camp Holabird, Md.; James W. Young, Camp Furlong, N. M.; John G. Miller, Governors Island, N. Y.; Frederick B. Tegener, Camp Jesup, Ga.

Major Chester M. Meares is ordered to active duty and will report in 8th corps area for duty.

Captain Frank E. Meyer ordered to active duty and to Camp Travis, Tex., for duty.

Appointment of William O. Boss as major, Dental Reserve Corps, effective January 1, is announced; to Washington Barracks, D. C., for duty.

Appointment of Adolphus E. Worsham as major, Dental Reserve Corps, effective January 1, is announced; to Camp Holabird, Md., for duty.

Appointment of Victor A. Vores as captain, Dental Reserve Corps, effective January 1, is announced; to Fort H. G. Wright, for duty.

Appointment of Walter L. Knowles as first lieutenant, Dental Reserve Corps, effective January 1, is announced; to Fort Bliss, Tex., for duty.—*Army and Navy Register, December 25, 1920.*

The following are honorably discharged:

Captain Victor A. Vores; First Lieutenant Walter L. Knowles.

Majors Adolphus E. Worsham and William O. Boss.

NEW BOOKS RECEIVED FOR THE LIBRARY OF THE JOURNAL OF THE NATIONAL DENTAL ASSOCIATION

The Journal of the National Dental Association promptly acknowledges here the receipt of new publications. Books selected from those named on this list are reviewed below. Reviews are matter-of-fact statements of the nature and contents of the publications referred to and are intended *solely to guide possible purchasers.*

The American Text-Book of Operative Dentistry. In Contributions by Eminent Authorities. Edited by Marcus L. Ward, D. D. Sc, Professor of Dental Metallurgy and Crown and Bridge-Work, and Dean of the College of Dental Surgery, University of Michigan. (Fifth edition, revised) 1920: pp. 768; $10.00; Lea & Febiger, Philadelphia, Pa.

Artificial Crown, Bridge and Porcelain Work George Evans, D. D. S., F. A. A. D. S.; (Eighth edition, revised and enlarged); 1143 illustrations; 1920; pp. 567. $..... P. Blakiston's Son & Co., Philadelphia, Pa.

Dental Materia Medica, Therapeutics and Prescription Writing. Eli H. Long, M. D., Professor of Dental Materia Medica and Therapeutics in the Dental Department, Emeritus Professor of Materia Medica and Therapeutics in the Medical Department, Professor of Toxicology in the Pharmacy Department, Univeristy of Buffalo; Consulting Physician to the Buffalo General Hospital; (Fourth edition, revised) 1920; Illustrated; pp. 338; $5.50; Lea & Febiger, Philadelphia, Pa.

Root-Canal Technic. Arthur Barton Crane, D. D. S.; (Illustrated with 48 engravings). 1920; pp. 115; $2.25; Lea & Febiger, Philadelphia, Pa.

Porcelain Dental Restorations. William A. Capon, D. D. S., Assistant Professor of Dental Ceramics, University of Pennsylvania; Author of Chapter on Restoration of Teeth by Cemented Inlays, American Text-Book of Operative Dentistry; Fellow American Academy of Dental Surgery. (Illustrated with 294 engravings). 1920; pp. 228; $3.25; Lea & Febiger, Philadelphia, Pa.

Dental Prosthetics. George Henry Wilson, D. D. S., Professor Emeritus of Prosthesis and Metallurgy in the Dental Department of Western Reserve University, Cleveland, Ohio; Special Professor of Prosthesis in the Dental Department of the University of Southern California, Los Angeles, Cal. (Fourth and revised edition, illustrated with 451 engravings). 1920; pp. 600; $5.50; Lea & Febiger, Philadelphia, Pa.

Dental Pathology and Therapeutics. For Students and Practitioners. Based upon the original of Henry H. Burchard, M. D., D. D. S., late special lecturer on Dental Pathology and Therapeutics in the Philadelphia Dental College. Rewritten by Otto E. Inglis, D. D. S., Professor of Dental Pathology and Therapeutics in the Philadelphia Dental College. (Sixth edition, thoroly revised, illustrated with 735 engravings and a colored plate). 1920; pp. 818; $7.00; Lea & Febiger, Philadelphia, Pa.

Block Anesthesia and Allied Subjects. Arthur E. Smith, D. D. S., M. D., Oral Surgeon to Frances Willard Hospital and to the House of Good Shepherd, Chicago. 1920; XXXV+ 895 pages. Illustrated. 6½x10. $15.00. C. V. Mosby Co., St. Louis, Mo.

Anesthetics. Dudley W. Buxton, M. D., B. S. Philadelphia, Pa., Blakiston's Son & Co., 1920. xiv+548. Illustrated. $6.00. (6th ed.)